# 6 Elementary Mathematics

# WORKBOOK

HARCOURT BRACE JOVANOVICH

## To the pupil

It is easy to do almost anything if you know how. You can jump rope or skate faster after you have had several chances to try. The exercises in this book give you another chance to try some things you know and to discover some things you may not know about mathematics. You can learn:

—To use answers you know to find answers you don't know.
—To be sure when to add, subtract, multiply, or divide.
—To know *about* how much your answer *should* be.
—To discover patterns and shortcuts that make your work easier.

Best of all, you will find out how to make mathematics *work for you*.

## To the teacher

In the series of Elementary Mathematics Workbooks, of which this is the sixth-grade workbook, the grade placement and sequence of topics parallels those of the companion textbooks in the *Elementary Mathematics* series.

As in the textbooks, the emphasis in the workbooks is not only on the topics of beginning mathematics but upon the relationships between the topics. The presentation of these topics as related to their interconnecting dependence on each other is a unique feature of the *Elementary Mathematics* series.

Because no topic in mathematics can be developed in a complete way at any one time, the *Elementary Mathematics* series returns intermittently to a topic again and again, each time expanding knowledge of the topic further and using insights gained from different topics in the interim.

Throughout these workbooks there is a carefully developed program for testing the pupil's progress and ability to apply his mathematical understanding to problem solving. A place for recording his progress is provided, so the child will be aware of his own growth.

We do not include a Teacher's Edition automatically with each shipment of a classroom set of textbooks. We prefer to send a Teacher's Edition only when it is part of a purchase order or when it is requested by the teacher or administrator concerned or by one of our representatives. A Teacher's Edition can be easily mislaid when it arrives as part of a shipment delivered to a school stockroom, and, since it contains answer materials, we would like to be sure it is sent *directly* to the person who will use it or to someone concerned with the use or selection of textbooks.

If your class assignment changes and you no longer are using or examining the Teacher's Edition, you may wish to pass it on to a teacher who may have use for it.

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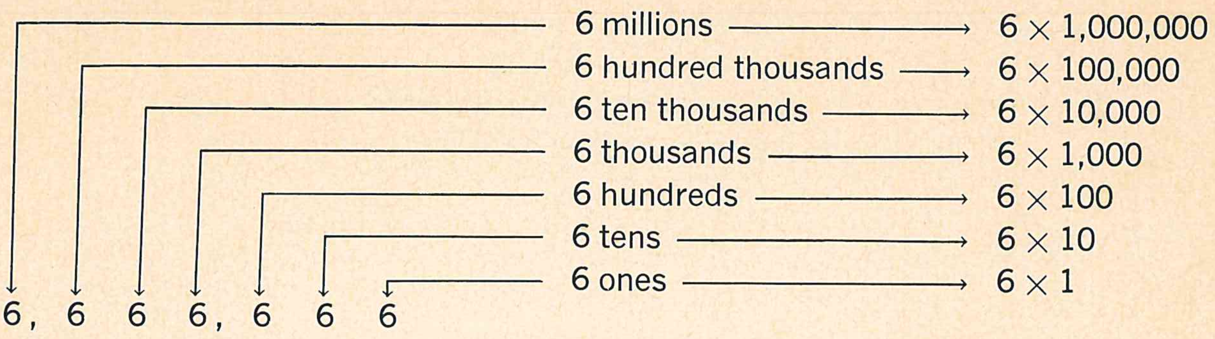
# Place value


6 millions → 6 × 1,000,000
6 hundred thousands → 6 × 100,000
6 ten thousands → 6 × 10,000
6 thousands → 6 × 1,000
6 hundreds → 6 × 100
6 tens → 6 × 10
6 ones → 6 × 1
6, 6 6 6, 6 6 6

The chart above shows that:

- the 6 in the tens place has 10 times the value of the 6 in the ones place.
- the 6 in the hundreds place has 10 times the value of the 6 in the tens place.
- any 6 has 10 times the value of the 6 to the right of it.

— In each decimal numeral below, the place value of the underlined digit is how many times the place value of the ringed digit?

| | a | | b | |
|---|---|---|---|---|
| **1.** | 5 $\underline{7}$⑦ | ____ | $\underline{1}$ 9① | ____ |
| **2.** | 3, $\underline{4}$ 1④ | ____ | 4, $\underline{2}$②0 | ____ |
| **3.** | $\underline{2}$ ,65② | ____ | 7, $\underline{5}$ 2⑤ | ____ |
| **4.** | $\underline{3}$ 4,86③ | ____ | 4 $\underline{4}$ ,98④ | ____ |
| **5.** | $\underline{5}$ 2,⑤34 | ____ | 1 $\underline{9}$ ,⑨63 | ____ |
| **6.** | 1 $\underline{8}$ ,⑧96 | ____ | $\underline{8}$ 0,12⑧ | ____ |
| **7.** | $\underline{9}$ 12,⑨84 | ________ | $\underline{6}$ 52,34⑥ | ________ |
| **8.** | $\underline{6}$ ,120,3⑥5 | ________ | 1, $\underline{3}$ 21,③11 | ________ |
| **9.** | $\underline{1}$ ,342,①00 | ________ | $\underline{7}$ ,336,51⑦ | ________ |
| **10.** | $\underline{8}$ ,17⑧,426 | ________ | 9, $\underline{1}$ 82,64① | ________ |
| **11.** | $\underline{7}$ ,549,361,3⑦4 | ________ | 5,12 $\underline{3}$ ,547,86③ | ________ |
| **12.** | $\underline{6}$ ,682,3⑥8,242 | ________ | 6, $\underline{4}$ 20,31④,589 | ________ |

# Naming numbers

— In each exercise below, use the given digits to name:

a the greatest number possible
b the least number possible

1. 3, 7, 1, and 2
a ________
b ________

2. 5, 4, and 5
a ________
b ________

3. 3, 0, 6, and 4
a ________
b ________

4. 2, 6, and 3
a ________
b ________

5. 0, 4, and 4
a ________
b ________

6. 8, 7, 9, and 6
a ________
b ________

7. 0, 1, 2, and 3
a ________
b ________

8. 3, 9, 6, and 4
a ________
b ________

9. 6, 2, 7, and 5
a ________
b ________

10. 4, 8, 5, and 6
a ________
b ________

11. 9, 5, 1, and 8
a ________
b ________

12. 9, 1, 9, and 0
a ________
b ________

13. 4, 0, 1, and 6
a ________
b ________

14. 3, 8, 0, and 7
a ________
b ________

15. 1, 3, 9, and 5
a ________
b ________

16. 8, 9, and 8
a ________
b ________

17. The odd numbers between 2 and 10
a ________
b ________

18. The even numbers between 1 and 9
a ________
b ________

WORK SPACE

# Understanding place value

You have already learned that numerals may be expressed in different ways. Shown below are 3 ways to express the numeral 2,847.

**a** $2{,}000 + 800 + 40 + 7$
**b** $(2 \times 1{,}000) + (8 \times 100) + (4 \times 10) + 7$
**c** $(2 \times 10 \times 10 \times 10) + (8 \times 10 \times 10) + (4 \times 10) + 7$

— Express the following numerals in the same 3 ways.

**1.** 5,426
**a** ______________________________
**b** ______________________________
**c** ______________________________

**2.** 927
**a** ______________________________
**b** ______________________________
**c** ______________________________

**3.** 3,589
**a** ______________________________
**b** ______________________________
**c** ______________________________

**4.** 7,028
**a** ______________________________
**b** ______________________________
**c** ______________________________

— Write a decimal numeral for each number named below.

**5.** $(1 \times 10 \times 10 \times 10 \times 10) + (3 \times 10 \times 10 \times 10) + (5 \times 10 \times 10) + (4 \times 10) + (2 \times 1)$ ____________

**6.** $(8 \times 10 \times 10 \times 10 \times 10) + (6 \times 10 \times 10 \times 10) + (4 \times 10 \times 10) + (2 \times 10) + (5 \times 1)$ ____________

**7.** $(3 \times 10 \times 10 \times 10 \times 10 \times 10) + (2 \times 10 \times 10 \times 10 \times 10) + (5 \times 10 \times 10 \times 10) + (7 \times 10 \times 10) + (4 \times 10) + (6 \times 1)$ ____________

**8.** $(9 \times 1{,}000{,}000) + (8 \times 100{,}000) + (6 \times 10{,}000) + (4 \times 1{,}000) + (2 \times 100) + (7 \times 10) + 0$ ____________

# Base-five numeration system

In a decimal numeral the value of each place is 10 times the value of the next place to the right.

The decimal numeral 123 means 1 hundred 2 tens 3 ones.

$$\begin{aligned} 123 &= (1 \times 10 \times 10) + (2 \times 10) + (3 \times 1) \\ &= 100 + 20 + 3 \\ &= 123 \end{aligned}$$

In a base-five numeral the value of each place is 5 times the value of the next place to the right.

The base-five numeral $443_{five}$ means 4 twenty-fives 4 fives 3 ones.

$$\begin{aligned} 443_{five} &= (4 \times 5 \times 5) + (4 \times 5) + 3 \\ &= 100 + 20 + 3 \\ &= 123 \end{aligned}$$

The number sentences above show that the decimal numeral 123 and the base-five numeral $443_{five}$ both name the same number.

— Complete each of the following sentences.

1. $234_{five} = (\underline{\quad} \times 5 \times 5) + (3 \times \underline{\quad}) + \underline{\quad} = 50 + \underline{\quad} + 4 = \underline{\quad}$

2. $132_{five} = (1 \times \underline{\quad} \times \underline{\quad}) + (\underline{\quad} \times 5) + 2 = \underline{\quad} + 15 + 2 = \underline{\quad}$

3. $410_{five} = (\underline{\quad} \times 25) + (1 \times \underline{\quad}) + \underline{\quad} = \underline{\quad} + \underline{\quad} + \underline{\quad} = \underline{\quad}$

4. $303_{five} = (\underline{\quad} \times \underline{\quad} \times \underline{\quad}) + (\underline{\quad} \times 5) + 3 = \underline{\quad} + \underline{\quad} + 3 = \underline{\quad}$

5. $341_{five} = (\underline{\quad} \times 25) + (\underline{\quad} \times \underline{\quad}) + \underline{\quad} = \underline{\quad} + 20 + \underline{\quad} = \underline{\quad}$

— What decimal numeral names the same number as each of these base-five numerals?

6. $222_{five} = (\underline{\quad} \times \underline{\quad} \times \underline{\quad}) + (\underline{\quad} \times \underline{\quad}) + \underline{\quad} = \underline{\quad} + \underline{\quad} + \underline{\quad} = \underline{\quad}$

7. $421_{five} = (\underline{\quad} \times \underline{\quad} \times \underline{\quad}) + (\underline{\quad} \times \underline{\quad}) + \underline{\quad} = \underline{\quad} + \underline{\quad} + \underline{\quad} = \underline{\quad}$

8. $320_{five} = (\underline{\quad} \times \underline{\quad} \times \underline{\quad}) + (\underline{\quad} \times \underline{\quad}) + \underline{\quad} = \underline{\quad} + \underline{\quad} + \underline{\quad} = \underline{\quad}$

9. $402_{five} = (\underline{\quad} \times \underline{\quad} \times \underline{\quad}) + (\underline{\quad} \times \underline{\quad}) + \underline{\quad} = \underline{\quad} + \underline{\quad} + \underline{\quad} = \underline{\quad}$

## Writing number names

— Based on a recent census the populations of various states are expressed below in decimal numerals. Write each one in word form.

1. Alabama — 3,266,740 ____________________

2. California — 15,717,204 ____________________

3. Delaware — 446,292 ____________________

4. Illinois — 10,081,158 ____________________

5. Maryland — 3,100,689 ____________________

6. Michigan — 7,823,194 ____________________

— The following populations are expressed in word form. Write a decimal numeral for each one.

7. Nebraska — one million, four hundred eleven thousand, three hundred thirty ____________

8. New Mexico — nine hundred fifty-one thousand, twenty-three ____________

9. New York — sixteen million, seven hundred eighty-two thousand, three hundred four ____________

10. North Dakota — six hundred thirty-two thousand, four hundred forty-six ____________

11. Ohio — nine million, seven hundred six thousand, three hundred ninety-seven ____________

12. Rhode Island — eight hundred fifty-nine thousand, four hundred eighty-eight ____________

# Decimal numerals and Roman numerals

— Study the table below.

| V | IV | VI | X | IX | XI | L | XL | LX | C | XC | CX | D | CD | DC | M | CM | MC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 4 | 6 | 10 | 9 | 11 | 50 | 40 | 60 | 100 | 90 | 110 | 500 | 400 | 600 | 1,000 | 900 | 1,100 |

— Rename each of these Roman numerals using a decimal numeral.

1. XXXIX ______
2. LVI ______
3. CXIX ______
4. CCLII ______
5. MCMXIV ______
6. DCXV ______
7. MMDCC ______
8. DLV ______
9. CMXC ______
10. MMMIII ______
11. CDXLVIII ______
12. LXXVI ______
13. DCCCXVII ______
14. CMXLI ______
15. MDCLXVI ______

— Rename each of these decimal numerals using a Roman numeral.

1. 648 ______
2. 483 ______
3. 3,702 ______
4. 291 ______
5. 1,044 ______
6. 876 ______
7. 2,930 ______
8. 712 ______
9. 559 ______
10. 965 ______
11. 3,102 ______
12. 477 ______
13. 1,614 ______
14. 2,883 ______
15. 1,928 ______

# Rounding numbers

Rounded *to the nearest hundred*, any number from 350 to 449 is 400; any number from 450 to 549 is 500.

**1.** Round each of these to the nearest hundred.

536 ______

879 ______

927 ______

1,909 ______

2,153 ______

1,037 ______

1,910 ______

2,998 ______

3,972 ______

4,809 ______

Rounded *to the nearest thousand*, any number from 1,500 to 2,499 is 2,000; any number from 2,500 to 3,499 is 3,000.

**2.** Round each of these to the nearest thousand.

3,964 ______

6,845 ______

8,951 ______

7,190 ______

9,486 ______

28,210 ______

47,860 ______

79,418 ______

89,876 ______

99,501 ______

— The causes and numbers of accidental deaths in the United States in the year 1966 are listed below. Round each number to the nearest hundred and to the nearest thousand.

| | | | NEAREST HUNDRED | NEAREST THOUSAND |
|---|---|---|---|---|
| **3.** | Motor vehicle | 38,137 | | |
| **4.** | Falls | 19,023 | | |
| **5.** | Burns | 7,645 | | |
| **6.** | Drowning | 6,529 | | |
| **7.** | Railroad | 2,391 | | |
| **8.** | Firearms | 2,334 | | |
| **9.** | Poison gases | 1,253 | | |
| **10.** | Other poisons | 1,679 | | |
| **11.** | Total | 78,991 | | |

**12.** Find the sum in each column. Then compare them with the total, 78,991.

# Open sentences and solution sets

The number sentence, $n + 4 > 7$, is an **open sentence.**

This set of whole numbers will make it true: $\{4, 5, 6, 7, \cdots\}$.

The three dots show that the numbers go on and on in the same way.

The number sentence below is an open sentence.

$$\blacksquare \times 2 = 8$$

There is only one member in the set of whole numbers that will make the sentence true: $\{4\}$

The set of numbers that make an open sentence true is called the **solution set** for the sentence.

— Use braces to show the solution set of whole numbers for each open sentence below. The first one in each column is done for you.

**1.** $24 + 19 = n$ $\{43\}$

**2.** $312 - 48 = \blacksquare$ ______

**3.** $7 \times 63 = \blacktriangle$ ______

**4.** $3 \times n = 24$ ______

**5.** $8 \times n = 8 \times 7$ ______

**6.** $12 + \blacksquare = 26$ ______

**7.** $n - 11 = 10$ ______

**8.** $\blacksquare \times 4 = 0$ ______

**9.** $\blacktriangle = 9 \times 19$ ______

**10.** $6 \times n = 6 \times 9$ ______

**11.** $\blacksquare \times 1 = 1$ ______

**12.** $211 - 33 = \blacktriangle$ ______

**13.** $n + 7 > 18$ $\{12, 13, 14, 15, \cdots\}$

**14.** $n + 9 < 20$ ______

**15.** $6 \times \blacksquare > 18$ ______

**16.** $4 \times \blacktriangle < 32$ ______

**17.** $n - 6 < 5$ ______

**18.** $5 + \blacktriangle > 3$ ______

**19.** $8 + 1 > n$ ______

**20.** $40 - \blacksquare > 33$ ______

**21.** $\blacktriangle \times 5 > 35$ ______

**22.** $7 \times \blacksquare < 56$ ______

**23.** $24 - n > 16$ ______

**24.** $9 \times \blacktriangle < 81$ ______

Try these

— Show the solution set for these sentences.

**25.** $20 + 30 > 50 + n$ ______

**26.** $n + 100 < 50 + 50$ ______

# Union of sets

Set A {⬡, △, ○}                Set B {□, ◇, ○}

Set C {⬡, △, ○, □, ◇}

> The union of two sets, such as A and B, is a new set, such as C, which includes all the members that are in either A or B, or in both, and no other members.
>
> This new set is named A ∪ B, meaning "the union of A and B," or "A union B."

**1.** In set A below, show the set of whole numbers between 5 and 10.

**2.** In set B, show the set of whole numbers between 7 and 14.

**3.** In set C, show the set of even numbers less than 5.

**4.** In set D, show the set of odd numbers less than 6.

A = { } B = { } C = { } D = { }

**5.** A ∪ B = { } A ∪ C = { }

**6.** B ∪ C = { } A ∪ D = { }

**7.** B ∪ D = { } C ∪ D = { }

**8.** What is the union of sets A, B, C, and D? { }

**9.** In set E, show the set of whole numbers between 10 and 50 that end in the digit 7. E = { }

**10.** In set F, show the set of whole numbers between 10 and 50 that end in the digit 0. F = { }

**11.** In set G, show the set of whole numbers between 10 and 50 that end in the digit 4. G = { }

**12.** E ∪ F = { } F ∪ G = { }

E ∪ G = { }

**13.** What is the union of sets E, F, and G? { }

# Intersection of sets

Set A {⬡, ○, △, ◇, □}  Set B {▭, ○, ▽, △, ◺, □}

Set C {○, △, □}

The intersection of two sets, such as A and B, is a new set, such as C, which contains only the members that are in both A and B.

This new set is named A ∩ B, meaning "the intersection of A and B," or "A intersection B."

**1.** Set X is the set of players on the Oakland School's baseball team.

Set Y is the set of players on the Oakland School's basketball team.

Which boys are on both teams?

X = {Walter, John, Ted, Harry, Roger, Peter, Jerry, Victor, Fred}

Y = {Chris, Ted, Allan, Bill, Peter}

X ∩ Y = {________, ________}

________ ________

**2.** In set A below, show the set of whole numbers less than 6.

**3.** In set B, show the set of whole numbers greater than 3 and less than 10.

**4.** In set C, show the set of even numbers between 3 and 15.

**5.** In set D, show the set of odd numbers between 2 and 14.

A = { }  B = { }

C = { }  D = { }

**6.** A ∩ B = { }  A ∩ D = { }  B ∩ C = { }

**7.** A ∩ C = { }  C ∩ D = { }  B ∩ D = { }

**8.** What is the intersection of sets A, B, and C? { }

**9.** In set E, show the set of whole numbers between 5 and 30 that are multiples of 7.

E = { }

**10.** In set F, show the set of whole numbers between 10 and 40 that are multiples of 4.

F = { }

**11.** In set G, show the set of whole numbers between 15 and 50 that are multiples of 6.

G = { }

**12.** E ∩ F = { }  E ∩ G = { }  F ∩ G = { }

# Practice

$A = \{1, 3, 5, 7, 9, 11\}$
$B = \{7, 9, 11, 13, 15, 17\}$
$C = \{15, 16, 17, 18\}$
$D = \{1, 2, 3, 4, 5\}$
$E = \{2, 7, 11, 15, 50\}$

— Using sets A, B, C, D, and E shown at the right, list the members in each of the sets shown below.

| | a | b |
|---|---|---|
| **1.** | $A \cup B = \{ \qquad \}$ | $A \cap B = \{ \qquad \}$ |
| **2.** | $A \cup C = \{ \qquad \}$ | $A \cap C = \{ \qquad \}$ |
| **3.** | $A \cup D = \{ \qquad \}$ | $A \cap D = \{ \qquad \}$ |
| **4.** | $A \cup E = \{ \qquad \}$ | $A \cap E = \{ \qquad \}$ |
| **5.** | $B \cup C = \{ \qquad \}$ | $B \cap C = \{ \qquad \}$ |
| **6.** | $B \cup D = \{ \qquad \}$ | $B \cap D = \{ \qquad \}$ |
| **7.** | $B \cup E = \{ \qquad \}$ | $B \cap E = \{ \qquad \}$ |
| **8.** | $C \cup D = \{ \qquad \}$ | $C \cap D = \{ \qquad \}$ |
| **9.** | $C \cup E = \{ \qquad \}$ | $C \cap E = \{ \qquad \}$ |
| **10.** | $D \cup E = \{ \qquad \}$ | $D \cap E = \{ \qquad \}$ |

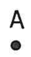
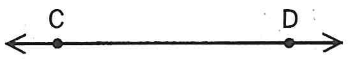
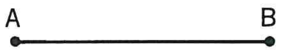
**11.** What is the intersection of sets A, B, and E? $\{ \qquad \}$

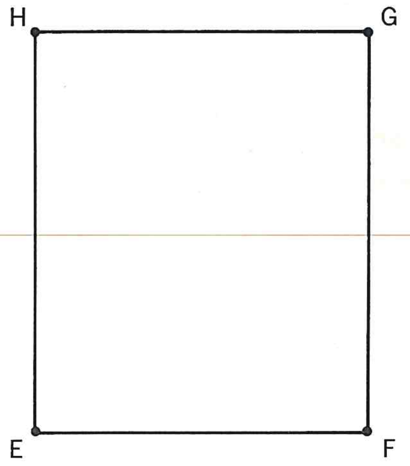
**12.** What is the intersection of sets B, C, and E? $\{ \qquad \}$

**13.** What is the union of sets A, B, C, D, and E?

$\{ \qquad \qquad \qquad \}$

# Points, lines, and line segments

| point | line | line segment |
|---|---|---|
|  point *A* |  $\overleftrightarrow{CD}$ or $\overleftrightarrow{DC}$ |  $\overline{AB}$ or $\overline{BA}$ |



**1.** Name the points shown in the drawing at the right.

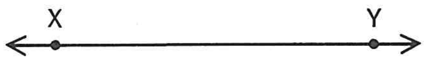
______ ______ ______ ______

**2.** In two ways, name each line segment.

______ ______ ______ ______

______ ______ ______ ______

**3.** In two ways, name the line shown below.

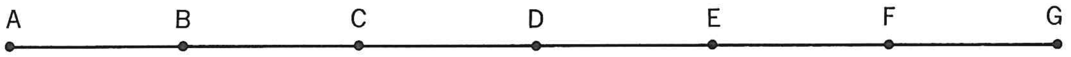


______ ______

**4.** In the space below, draw $\overleftrightarrow{PQ}$ and $\overline{RS}$.

Try this

— Using the labeled points in the drawing below as endpoints, there are actually 21 different line segments. In two ways, see how many of them you can name.



**1.** ______ ______

**2.** ______ ______

**3.** ______ ______

**4.** ______ ______

**5.** ______ ______

**6.** ______ ______

**7.** ______ ______

**8.** ______ ______

**9.** ______ ______

**10.** ______ ______

**11.** ______ ______

**12.** ______ ______

**13.** ______ ______

**14.** ______ ______

**15.** ______ ______

**16.** ______ ______

**17.** ______ ______

**18.** ______ ______

**19.** ______ ______

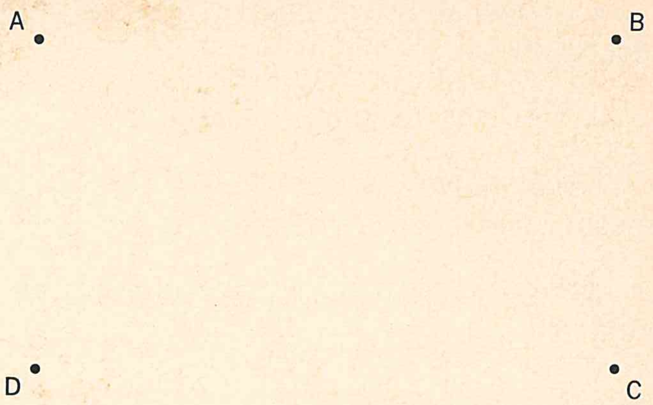
**20.** ______ ______

**21.** ______ ______

# Closed paths and plane regions

**1.** With your pencil start at point $A$ and draw $\overline{AB}$, $\overline{BC}$, $\overline{CD}$, and $\overline{DA}$.

The path you made is called a **closed path** because you came back to where you started.



**2.** The name of the closed path you made is a **rectangle.** Which segments are the same length? _____ and _____

_____ and _____

**3.** In your drawing, $\overline{AB}$ and $\overline{BC}$ are **perpendicular**. Name three other pairs of perpendicular sides.

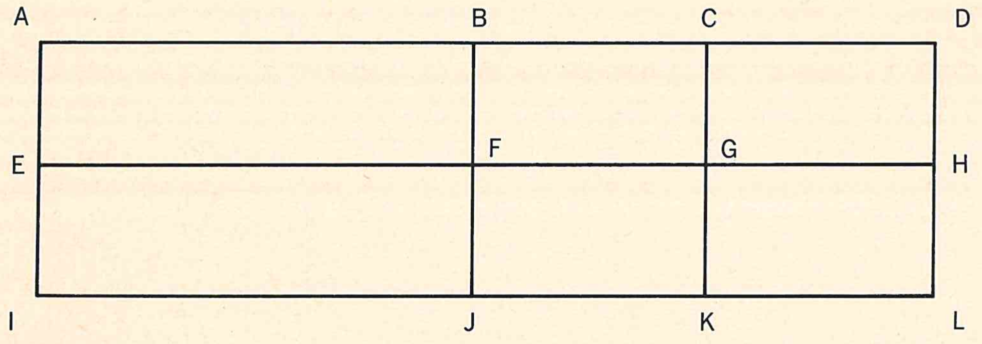
_____ and _____ _____ and _____ _____ and _____

**4.** In your drawing, $\overline{AB}$ and $\overline{DC}$ are **parallel** sides. Name another pair of parallel sides. _____ and _____

**5.** With your pencil shade the inside of the closed path you made above. The closed path and the inside that you shaded is called a **plane region**.

Try this

The figure below actually contains 18 rectangles. The list has been started for you. See if you can complete it.

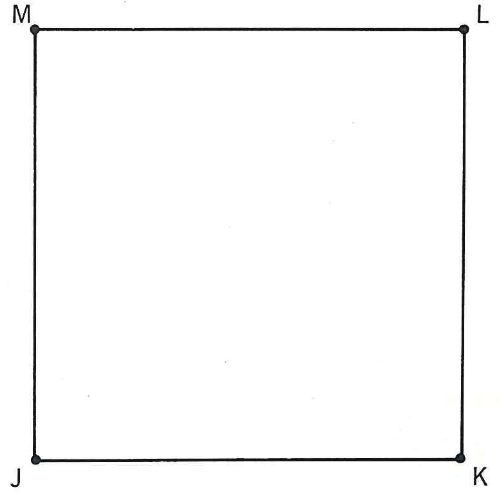


1. *ADLI*
2. *ADHE*
3. *ACKI*
4. ______
5. ______
6. ______
7. ______
8. ______
9. ______
10. ______
11. ______
12. ______
13. ______
14. ______
15. ______
16. ______
17. ______
18. ______

# Union and intersection of line segments

You can think of rectangle $JKLM$ as the union of four segments.

$$\overline{JK} \cup \overline{KL} \cup \overline{LM} \cup \overline{MJ}$$



The intersection of $\overline{JK}$ and $\overline{KL}$ is point $K$. The intersection of $\overline{JK}$ and $\overline{ML}$ is the empty set.

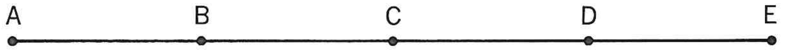
— What points will make these mathematical sentences true?

**1.** $\overline{KL} \cap \overline{LM} =$ _____

**2.** $\overline{LM} \cap \overline{MJ} =$ _____

**3.** $\overline{MJ} \cap \overline{JK} =$ _____

— Using the drawing below, complete the following mathematical sentences. (The unions and intersections can be points, segments, or empty sets.)



**4.** $\overline{AC} \cap \overline{CD} =$ _____

**5.** $\overline{AC} \cap \overline{BD} =$ _____

**6.** $\overline{AB} \cap \overline{CD} =$ _____

**7.** $\overline{BC} \cup \overline{CD} =$ _____

**8.** $\overline{AD} \cup \overline{BE} =$ _____

**9.** $\overline{AD} \cap \overline{BE} =$ _____

**10.** $\overline{BD} \cap \overline{DE} =$ _____

**11.** $\overline{AD} \cap \overline{BC} =$ _____

**12.** $\overline{BD} \cup \overline{CD} =$ _____

**13.** $\overline{BC} \cap \overline{DE} =$ _____

**14.** $\overline{CD} \cap$ point $D =$ _____

**15.** $\overline{BC} \cap$ point $E =$ _____

**16.** $\overline{BD} \cap$ point $C =$ _____

**17.** $\overline{AB} \cap$ point $B =$ _____

---

**18.** In the space at the right, draw a closed path which is the union of three line segments.

Name the endpoints of the segments with capital letters. Then use the letters and the symbol for union to write a mathematical sentence for what you have shown.

# Properties of addition

The **commutative property of addition** states that the order in which you add two addends does not affect their sum.

$5 + 6 = 6 + 5$ $\qquad$ $573 + 152 = 152 + 573$

The **associative property of addition** states that in finding the sum of three or more addends, the way in which you pair neighboring addends does not affect their sum.

$(4 + 5) + 6 = 4 + (5 + 6)$ $\qquad$ $70 + (85 + 90) = (70 + 85) + 90$

— Look at each of the following true sentences. Then make a check mark under the heading that indicates the property that tells you it is true.

| | COMMUTATIVE PROPERTY | ASSOCIATIVE PROPERTY |
|---|---|---|
| **1.** $17 + 21 = 21 + 17$ | | |
| **2.** $(9 + 8) + 5 = 9 + (8 + 5)$ | | |
| **3.** $41 + (25 + 17) = (41 + 25) + 17$ | | |
| **4.** $0 + 179 = 179 + 0$ | | |
| **5.** $3 + 5 + 7 = 3 + 7 + 5$ | | |
| **6.** $12 + (200 + 37) = (12 + 200) + 37$ | | |
| **7.** $(263 + 0) + 149 = 263 + (0 + 149)$ | | |
| **8.** $689 + 746 + 55 = 55 + 689 + 746$ | | |

— What number (or numbers) will make each sentence true?

| | a | b |
|---|---|---|
| **9.** | $\underline{\qquad} + 168 = 168 + 0$ | $57 + (33 + 5) = (57 + \underline{\qquad}) + 5$ |
| **10.** | $\underline{\qquad} + 500 = 500 + 200$ | $43 + (31 + 12) = (\underline{\qquad} + \underline{\qquad}) + 12$ |
| **11.** | $10 + 5 + 9 = 10 + \underline{\qquad} + 5$ | $(94 + 80) + 4 = \underline{\qquad} + (\underline{\qquad} + 4)$ |
| **12.** | $50 + \underline{\qquad} + 30 = 50 + 30 + 20$ | $\underline{\qquad} + (\underline{\qquad} + 10) = (33 + 75) + 10$ |

**13.** $100_{five} + 200_{five} = 200_{five} + \underline{\qquad\quad}$

**14.** $(212_{five} + 233_{five}) + 304_{five} = 212_{five} + (\underline{\qquad\quad} + \underline{\qquad\quad})$

# Using the commutative and associative properties

Many times, addition can be made easier by applying the commutative and associative properties. This is especially true if you can group a pair of numbers whose sum is ten or some multiple of ten. For example:

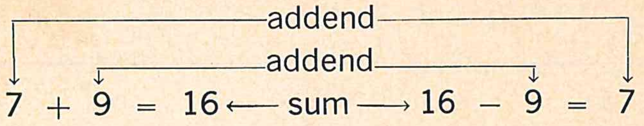
- $8 + 11 + 12 = (8 + 12) + 11 = 20 + 11 = 31$
- $6 + 3 + 14 + 7 = (6 + 14) + (3 + 7) = 20 + 10 = 30$

— Use this idea in the following number sentences, showing your answers.

1. 9 + 7 + 11 = ____________________
2. 15 + 8 + 5 = ____________________
3. 4 + 8 + 26 = ____________________
4. 18 + 6 + 12 = ____________________
5. 17 + 4 + 3 = ____________________
6. 5 + 16 + 25 = ____________________
7. 34 + 7 + 6 = ____________________
8. 3 + 8 + 7 + 2 = ____________________
9. 5 + 4 + 5 + 6 = ____________________
10. 14 + 15 + 16 + 25 = ____________________
11. 6 + 7 + 8 + 14 + 3 = ____________________
12. 5 + 9 + 2 + 31 + 8 = ____________________
13. 37 + 9 + 13 = ____________________
14. 25 + 17 + 25 = ____________________
15. 41 + 12 + 9 = ____________________
16. 16 + 17 + 24 = ____________________
17. 11 + 12 + 13 + 8 + 9 = ____________________
18. 4 + 5 + 6 + 15 + 13 + 11 + 7 = ____________________

# Subtraction, the inverse of addition

The diagram at the right shows that subtraction is the inverse of addition.



**1.** In each sentence below, when you find the number that makes the sentence true, you are finding the other addend. What is the other addend? _____

$18 + n = 25 \qquad n + 18 = 25 \qquad 25 - n = 18 \qquad 25 - 18 = n$

— Use the first example in each row to name the other addend in each of the other examples in the row.

**2.** $\begin{array}{r} 59 \\ +47 \\ \hline 106 \end{array} \qquad \begin{array}{r} 106 \\ -47 \\ \hline \end{array} \qquad \begin{array}{r} 106 \\ -59 \\ \hline \end{array} \qquad \begin{array}{r} 106 \\ -\phantom{59} \\ \hline 47 \end{array} \qquad \begin{array}{r} 106 \\ -\phantom{59} \\ \hline 59 \end{array}$

**3.** $\begin{array}{r} 691 \\ +284 \\ \hline 975 \end{array} \qquad \begin{array}{r} 975 \\ -284 \\ \hline \end{array} \qquad \begin{array}{r} 975 \\ -691 \\ \hline \end{array} \qquad \begin{array}{r} 975 \\ -\phantom{284} \\ \hline 284 \end{array} \qquad \begin{array}{r} 975 \\ -\phantom{284} \\ \hline 691 \end{array}$

**4.** The subtraction example at the right shows you how to subtract 286 from 504. The sum, 504, is renamed as _____ hundreds _____ tens _____ ones.

Complete the check.

$\begin{array}{r} \overset{4}{\cancel{5}}\overset{9}{\cancel{0}}\overset{14}{\cancel{4}} \\ -286 \\ \hline 218 \end{array}$

**Check:**

$\begin{array}{r} 218 \\ +286 \\ \hline \end{array}$

— Compute and check the following examples.

| | a | b | c |
|---|---|---|---|
| **5.** | $\begin{array}{r} 871 \\ -493 \\ \hline \end{array}$ CHECK | $\begin{array}{r} 824 \\ -795 \\ \hline \end{array}$ CHECK | $\begin{array}{r} \$7.50 \\ -3.86 \\ \hline \end{array}$ CHECK |
| **6.** | $\begin{array}{r} 2{,}780 \\ -1{,}356 \\ \hline \end{array}$ CHECK | $\begin{array}{r} 3{,}600 \\ -1{,}765 \\ \hline \end{array}$ CHECK | $\begin{array}{r} \$50.00 \\ -34.99 \\ \hline \end{array}$ CHECK |

# Equalities and inequalities

— Find the answers for each pair of examples below. Then insert the correct symbol, >, =, or <, between the answers. The first pair of examples is done for you.

| | | a | | | b | | | c | |
|---|---|---|---|---|---|---|---|---|---|
| **1.** | 8<br>2<br>4<br>7<br>+1<br>22 | ⊜ | 5<br>1<br>6<br>3<br>+7<br>22 | 9<br>9<br>2<br>8<br>+7 | ○ | 6<br>4<br>5<br>8<br>+9 | 9<br>6<br>0<br>5<br>+7 | ○ | 8<br>7<br>4<br>9<br>+2 |
| **2.** | 52<br>93<br>68<br>57<br>34<br>+76 | ○ | 96<br>58<br>39<br>47<br>76<br>+54 | 77<br>58<br>49<br>93<br>67<br>+58 | ○ | 86<br>90<br>69<br>83<br>74<br>+37 | 70<br>83<br>29<br>35<br>43<br>+55 | ○ | 98<br>64<br>40<br>12<br>75<br>+26 |
| **3.** | 509<br>750<br>900<br>301<br>+460 | ○ | 838<br>610<br>462<br>720<br>+300 | 376<br>489<br>750<br>672<br>+248 | ○ | 568<br>856<br>297<br>443<br>+371 | 5,079<br>6,807<br>4,095<br>7,650<br>+1,416 | ○ | 7,088<br>3,076<br>2,950<br>8,024<br>+1,909 |
| **4.** | 82<br>−20 | ○ | 76<br>−26 | 46<br>−27 | ○ | 54<br>−33 | 64<br>−18 | ○ | 58<br>−12 |
| **5.** | 359<br>−235 | ○ | 347<br>−105 | 461<br>−129 | ○ | 741<br>−409 | 608<br>−594 | ○ | 710<br>−697 |
| **6.** | 5,070<br>−2,987 | ○ | 3,781<br>−1,698 | 8,010<br>−5,013 | ○ | 6,070<br>−3,171 | 4,006<br>−1,753 | ○ | 3,984<br>−986 |

# Adding and subtracting mentally

To add 34 and 57 mentally, you could think:

$\boxed{1}$ (30 + 50) + (4 + 7) = 80 + 11 = 91
$\boxed{2}$ (34 + 50) + 7 = 84 + 7 = 91
$\boxed{3}$ (34 + 60) − 3 = 94 − 3 = 91

**1.** Shown below are three ways of adding 49 and 27 mentally. Which way do you prefer? _____

$\boxed{1}$ (40 + 20) + (9 + 7) = _____ $\boxed{2}$ (49 + 20) + 7 = _____ $\boxed{3}$ (49 + 30) − 3 = _____

— For each number sentence below, find the sum mentally. Use the method you prefer.

**2.** 29 + 63 = _____ 47 + 28 = _____ 52 + 39 = _____ 74 + 17 = _____
**3.** 85 + 42 = _____ 71 + 53 = _____ 94 + 69 = _____ 63 + 74 = _____
**4.** 137 + 47 = _____ 254 + 38 = _____ 168 + 42 = _____ 409 + 56 = _____

To subtract 18 from 72 mentally, you could think:

$\boxed{1}$ (72 − 10) − 8 = 62 − 8 = 54
$\boxed{2}$ (72 − 20) + 2 = 52 + 2 = 54

**5.** Shown below are two ways of subtracting 29 from 137 mentally. Which way do you prefer? _____

$\boxed{1}$ (137 − 20) − 9 = _____ $\boxed{2}$ (137 − 30) + 1 = _____

— For each number sentence below, find the answer mentally. Use the method you prefer.

**6.** 73 − 45 = _____ 87 − 49 = _____ 65 − 38 = _____ 94 − 33 = _____
**7.** 84 − 26 = _____ 205 − 35 = _____ 235 − 57 = _____ 375 − 48 = _____
**8.** 475 − 69 = _____ 589 − 47 = _____ 173 − 128 = _____ 600 − 349 = _____

# Problem solving and practice

**1.** Joan has saved \$6.04. Her sister Judith has saved \$2.87. Joan has saved ________ more than Judith.

**2.** There are 1,632 students in the Homedale School. Of these students, 948 are boys. There are ________ girls in the school.

**3.** On a trip, the Smiths traveled 517 miles the first day, 489 the second, 468 the third, and 530 the fourth day. In all, they traveled ________ miles.

**4.** Tom was given \$5.00 for his birthday. He bought a science kit for \$1.85. Tom should have ________ left.

**5.** At a Scout Rally there were 468 scouts from New York, 583 from New Jersey, and 624 from Pennsylvania. In all, ________ scouts attended the rally.

**6.** A class party committee spent \$6.75 for refreshments, \$2.25 for decorations, and \$1.49 for prizes. In all, they spent ________.

**7.** Joe can get a new pair of skates for \$6.49. He can buy Dave's outgrown skates for \$3.75. Joe can save ________ by buying the skates from Dave.

**8.** The following numbers of students attend Elm City's four schools: 689, 421, 592, and 376. In all, ________ students attend Elm City's schools.

| | |
|---|---|
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |
| 7 | 8 |

— Find the number that makes each sentence true.

| | a | | b | |
|---|---|---|---|---|
| **9.** | $n + 18 = 32$ | $n =$ _____ | $n - 14 = 15$ | $n =$ _____ |
| **10.** | $n - 26 = 9$ | $n =$ _____ | $27 - n = 12$ | $n =$ _____ |
| **11.** | $84 - n = 30$ | $n =$ _____ | $55 - n = 28$ | $n =$ _____ |
| **12.** | $31 + 17 = n$ | $n =$ _____ | $16 + 38 = n$ | $n =$ _____ |
| **13.** | $42 + n = 60$ | $n =$ _____ | $9 + n = 71$ | $n =$ _____ |
| **14.** | $n - 11 = 15$ | $n =$ _____ | $n - 43 = 11$ | $n =$ _____ |
| **15.** | $n + 11 = 20$ | $n =$ _____ | $45 - n = 12$ | $n =$ _____ |

# Solution sets

Study the solution sets of whole numbers for these sentences.

$n \times 5 > 15$ $\{4, 5, 6, \cdots\}$
$n \times 5 = 15$ $\{3\}$
$n \times 5 \geq 15$ $\{3, 4, 5, \cdots\}$

The symbol $\geq$ is read "is greater than or equal to."

$n \times 5 < 15$ $\{0, 1, 2\}$
$n \times 5 = 15$ $\{3\}$
$n \times 5 \leq 15$ $\{0, 1, 2, 3\}$

The symbol $\leq$ is read "is less than or equal to."

— If $n$ stands for any whole number, find the solution set for each sentence below. The first one is done for you.

**a** **b**

**1.** $n \times 3 \geq 18$ $\{6, 7, 8, \cdots\}$ $n \times 6 \leq 30$ ____________
**2.** $n \times 8 \leq 64$ ____________ $n \times 9 \geq 45$ ____________
**3.** $n \times 6 \leq 24$ ____________ $5 \times n \geq 40$ ____________
**4.** $n \times 3 \geq 27$ ____________ $7 \times n \leq 49$ ____________

— What is the least whole number that will make each sentence true?

**5.** $n \times 3 \geq 21$ ____ $n \times 4 \geq 32$ ____ $n \times 6 \geq 54$ ____
**6.** $n \times 7 \geq 56$ ____ $n \times 8 \geq 72$ ____ $n \times 9 \geq 81$ ____

— What is the greatest whole number that will make each sentence true?

**7.** $n \times 3 \leq 24$ ____ $n \times 4 \leq 20$ ____ $n \times 6 \leq 42$ ____
**8.** $n \times 7 \leq 63$ ____ $n \times 8 \leq 48$ ____ $n \times 9 \leq 63$ ____

— What is the greatest multiple of 10 that will make each sentence true?

**9.** $n \times 8 \leq 400$ ____ $n \times 6 \leq 180$ ____ $n \times 2 \leq 140$ ____
**10.** $n \times 5 \leq 350$ ____ $n \times 3 \leq 270$ ____ $n \times 4 \leq 240$ ____
**11.** $n \times 7 \leq 280$ ____ $n \times 8 \leq 560$ ____ $n \times 9 \leq 540$ ____

# Properties of multiplication

**Commutative Property:** Changing the order of two factors does not affect the product. 13 × 14 = 14 × 13

**Associative Property:** The way in which neighboring factors are paired does not affect the product of three or more numbers.

3 × (5 × 2) = (3 × 5) × 2

**Distributive Property:** When multiplying two addends by a number, the product is not affected whether you add first and then multiply, or multiply each addend separately and then add the products.

3 × (20 + 5) = (3 × 20) + (3 × 5)

— Notice how each sentence below is expressed. In the blank, name the number that will make the sentence true.

Then decide which property is used and put a check mark (√) in the proper column. (If none of the properties is used, place a dash (—) in each column.) The first two are done for you.

| | COMMUTATIVE PROPERTY | ASSOCIATIVE PROPERTY | DISTRIBUTIVE PROPERTY |
|---|---|---|---|
| **1.** 26 × 123 = 123 × 26 | √ | | |
| **2.** 4 × 12 = 8 × 6 | — | — | — |
| **3.** (40 × 30) × ____ = 40 × (30 × 50) | | | |
| **4.** 6 × (80 + 2) = (6 × 80) + (6 × ____) | | | |
| **5.** 64 × (15 × ____) = (64 × 15) × 5 | | | |
| **6.** 1,958 × 0 = ____ × 1,958 | | | |
| **7.** ____ × (20 + 10) = (400 × 20) + (400 × 10) | | | |
| **8.** ____ × 2 = 6 × 5 | | | |
| **9.** 130 × ____ = 180 × 130 | | | |
| **10.** (15 × 10) × 50 = 15 × (____ × 50) | | | |
| **11.** 9 × (30 + 40) = (9 × ____) + (9 × 40) | | | |
| **12.** 2 × 2 × 2 × 2 = ____ × 4 | | | |
| **13.** (70 + 8) × 7 = (70 × 7) + (8 × ____) | | | |
| **14.** (101 × 32) × 4 = ____ × (32 × 4) | | | |
| **15.** ____ × 190 = 190 × 3,003 | | | |
| **16.** 80 × (100 + 20) = (80 × 100) + (____ × 20) | | | |

## Using the associative and commutative properties

The associative and commutative properties can be used to group a pair of factors whose product is ten or some multiple of ten. For example:

- $3 \times 4 \times 5 = 3 \times (4 \times 5) = 3 \times 20 = 60$
- $2 \times 3 \times 5 = (2 \times 5) \times 3 = 10 \times 3 = 30$
- $2 \times 3 \times 5 \times 7 = (2 \times 5) \times (3 \times 7) = 10 \times 21 = 210$

— Use this idea in the following number sentences. Show each step. The first one is done for you.

**1.** $5 \times 7 \times 8 =$ $(5 \times 8) \times 7 = 40 \times 7 = 280$

**2.** $3 \times 5 \times 6 =$ ____________

**3.** $9 \times 4 \times 5 =$ ____________

**4.** $2 \times 7 \times 5 =$ ____________

**5.** $7 \times 5 \times 6 =$ ____________

**6.** $2 \times 3 \times 5 \times 3 =$ ____________

**7.** $3 \times 4 \times 5 \times 7 =$ ____________

**8.** $7 \times 4 \times 5 =$ ____________

**9.** $2 \times 13 \times 5 =$ ____________

**10.** $11 \times 5 \times 4 =$ ____________

**11.** $8 \times 3 \times 5 \times 7 =$ ____________

**12.** $4 \times 7 \times 5 \times 9 =$ ____________

— In these sentences, see if you can group *three* factors whose product is 100.

**13.** $4 \times 7 \times 5 \times 5 =$ ____________

**14.** $2 \times 3 \times 2 \times 25 =$ ____________

**15.** $2 \times 9 \times 5 \times 10 =$ ____________

**16.** $5 \times 3 \times 4 \times 5 =$ ____________

**17.** $2 \times 2 \times 9 \times 25 =$ ____________

**18.** $10 \times 7 \times 2 \times 5 =$ ____________

# Using the distributive property

The distributive property can be used to solve multiplication sentences as shown below. Study each step.

- 8 × 12 = 8 × (10 + 2) = (8 × 10) + (8 × 2) = 80 + 16 = 96
- 13 × 12 = 13 × (10 + 2) = (13 × 10) + (13 × 2) = 130 + 26 = 156

— Use this idea to solve the following multiplication sentences.

**1.** 9 × 13 = ______

**2.** 7 × 24 = ______

**3.** 4 × 17 = ______

**4.** 8 × 38 = ______

**5.** 5 × 56 = ______

**6.** 3 × 87 = ______

**7.** 12 × 14 = ______

**8.** 11 × 19 = ______

**9.** 16 × 16 = ______

**10.** 19 × 22 = ______

**11.** 17 × 15 = ______

**12.** 14 × 13 = ______

**13.** 21 × 23 = ______

**14.** 34 × 12 = ______

**15.** 26 × 15 = ______

**16.** 31 × 23 = ______

**17.** 28 × 12 = ______

**18.** 51 × 11 = ______

**19.** 42 × 14 = ______

**20.** 27 × 32 = ______

# Practice with multiplication

— Find the products.

| | a | b | c | d | e | f |
|---|---|---|---|---|---|---|
| **1.** | 43<br>×24 | 52<br>×35 | 65<br>×37 | 73<br>×28 | 86<br>×56 | 94<br>×49 |
| **2.** | 403<br>×25 | 134<br>×75 | 380<br>×39 | 416<br>×52 | 590<br>×27 | 804<br>×43 |
| **3.** | 576<br>×234 | 803<br>×376 | 985<br>×504 | 672<br>×448 | 705<br>×830 | 509<br>×608 |

**4.** A factory pays employees $1.40 per hour. How much money does an employee make in a 40-hour week? ______

**5.** Mr. Sealy used 86 gallons of gasoline on a trip. If it costs $.36 a gallon, how much did Mr. Sealy spend on gasoline? ______

**6.** Carol spends 20¢ each day for bus fare and 35¢ each day for lunch. How much does Carol spend in a month that has 22 school days? ______

**7.** A warehouse has 480 cases of canned vegetables. Each case holds 24 cans. How many cans of vegetables are stored in the warehouse? ______

**8.** Tickets for a Benefit Bridge were $1.25 each. There were 75 tables set up for 4 players at a table. If all the tables were filled, how much money was collected? ______

WORK SPACE

# Division and number sentences

**1.** This is the set of multiples of 4.

$$\{0, 4, 8, 12, 16, \cdots\}$$

Name the next six multiples of 4.

____ ____ ____ ____ ____ ____

**2.** What whole number will make each sentence true?

$\_\_\_\_ \times 4 = 20$ $\_\_\_\_ \times 4 = 28$

$\_\_\_\_ \times 4 = 36$ $\_\_\_\_ \times 4 = 40$

**3.** What are the solution sets for these sentences?

$n \times 4 \le 13$ ____________

$n \times 4 \le 20$ ____________

**4.** What is the greatest number that will make these sentences true?

$n \times 4 \le 23$ ____ $n \times 4 \le 36$ ____

$n \times 4 \le 19$ ____ $n \times 4 \le 33$ ____

**5.** What whole number makes these sentences true?

$\_\_\_\_ \times 4 = 32$ $32 \div 4 = \_\_\_\_$

**6.** In $n \times 4 \le 38$, the greatest whole number that makes it true is ____.

Then what number must $r$ stand for in this sentence to make it true? ____

$$38 = (n \times 4) + r$$

— As shown above, name the numbers that will make these sentences true.

**7.** $15 = (\_\_\_\_ \times 4) + \_\_\_\_$

**8.** $17 = (\_\_\_\_ \times 4) + \_\_\_\_$

**9.** $34 = (\_\_\_\_ \times 4) + \_\_\_\_$

**10.** $28 = (\_\_\_\_ \times 4) + \_\_\_\_$

**11.** $35 = (\_\_\_\_ \times 4) + \_\_\_\_$

**12.** $30 = (\_\_\_\_ \times 4) + \_\_\_\_$

# Estimating quotients

**1.** To estimate the quotient for 315 divided by 4, think:

- 315 is about 31 tens.
- 31 tens ÷ 4 is about 7 tens, or 70. The quotient is 70-some.

**2.** To estimate the quotient for 2,348 divided by 6, think:

- 2,348 is about 23 hundreds.
- 23 hundreds ÷ 6 is about 3 hundreds, or 300. The quotient is 300-some.

— Estimate the quotients. The first one is done for you.

**3.** $\overset{30\text{-some}}{7\overline{)225}}$ $3\overline{)2,117}$

**4.** $5\overline{)492}$ $6\overline{)1,829}$

**5.** $8\overline{)593}$ $8\overline{)2,520}$

**6.** $4\overline{)383}$ $5\overline{)2,898}$

**7.** $6\overline{)505}$ $7\overline{)5,838}$

# Practice with division

— First, estimate the quotient; then find the answer. Check on a separate piece of paper. The first example is done for you.

| | a | b | c | d | e |
|---|---|---|---|---|---|
| 1. | $\begin{array}{r} 183 \\ 4\overline{)732} \\ \underline{400} \\ 332 \\ \underline{320} \\ 12 \\ \underline{12} \\ 0 \end{array}$ | $3\overline{)826}$ | $6\overline{)402}$ | $5\overline{)345}$ | $8\overline{)672}$ |
| 2. | $9\overline{)2,988}$ | $7\overline{)4,081}$ | $8\overline{)5,143}$ | $7\overline{)3,248}$ | $5\overline{)4,321}$ |
| 3. | $2\overline{)7,356}$ | $3\overline{)4,314}$ | $6\overline{)8,511}$ | $6\overline{)6,145}$ | $4\overline{)3,427}$ |
| 4. | $3\overline{)\$5.52}$ | $7\overline{)\$22.05}$ | $8\overline{)\$12.24}$ | $5\overline{)\$73.15}$ | $4\overline{)\$34.72}$ |
| 5. | $9\overline{)8,763}$ | $6\overline{)5,124}$ | $7\overline{)8,505}$ | $8\overline{)8,200}$ | $9\overline{)2,934}$ |

# Finding averages

| TEAM | TICKETS |
|---|---|
| Blue | 70 |
| Red | 44 |
| Green | 48 |
| Yellow | +62 |
| | 224 |

$$\begin{array}{r} 56 \\ 4\overline{)224} \end{array} \longleftarrow \text{Average}$$

**1.** Four teams of students sold tickets to a swimming meet. Look at their record.

In all, the four teams sold _____ tickets.

**2.** To find the average number of tickets sold per team, divide the total by the number of teams. 224 ÷ 4 = _____

An average of _____ tickets per team was sold.

— Find the average of the numbers in each set.

WORK SPACE

**3.** {153, 231} _____

**4.** {52, 36, 44, 28} _____

**5.** {12, 38, 26, 44, 30} _____

**6.** {27, 47, 70} _____

**7.** {13, 19, 32, 41, 56, 13} _____

**8.** {17, 41, 26, 8} _____

**9.** {123, 72, 18} _____

**10.** {42, 23, 16, 34, 15} _____

**11.** {19, 7, 14, 28, 32, 8} _____

**12.** {49, 27, 18, 10} _____

**13.** {43, 59, 16, 8, 34} _____

**14.** {94, 12, 31, 65, 82, 10} _____

**15.** {47, 16, 5, 29, 3, 26} _____

**16.** {16, 48, 67, 23, 12, 32} _____

**17.** During a drive for magazine subscriptions, Bob sold two at \$3.50 each, Bill sold five at \$2.80 each, and Jim sold three at \$4.50 each. What were: Bob's total sales? _______ Bill's? _______ Jim's? _______ the total sales for all three boys? _______

The average sales total per boy was _______.

**17**

# Division practice

— Find the quotients. Check on a separate piece of paper. The first one is done for you.

| | a | b | c | d | e |
|---|---|---|---|---|---|
| **1.** | 28<br>34)952<br>680<br>272<br>272<br>0 | 27)621 | 18)594 | 54)2,322 | 67)2,747 |
| **2.** | 52)884 | 75)5,625 | 47)1,081 | 28)1,092 | 93)1,116 |
| **3.** | 23)1,058 | 84)2,184 | 39)2,769 | 78)1,872 | 43)1,290 |
| **4.** | 61)1,525 | 13)923 | 88)2,816 | 14)756 | 29)928 |
| **5.** | 31)2,263 | 45)1,710 | 57)1,482 | 64)2,176 | 73)4,872 |
| **6.** | 98)1,415 | 86)9,206 | 15)6,030 | 39)8,364 | 76)7,670 |

# Common multiples

— Name the first six multiples of each number.

1. 5 ________ 7 ________
2. 9 ________ 10 ________
3. 11 ________ 12 ________

— Name four common multiples for each pair of numbers.

WORK SPACE

4. 4 and 5 ____ ____ ____ ____
5. 5 and 6 ____ ____ ____ ____
6. 3 and 8 ____ ____ ____ ____
7. 6 and 10 ____ ____ ____ ____
8. 3 and 10 ____ ____ ____ ____
9. 10 and 20 ____ ____ ____ ____
10. 5 and 10 ____ ____ ____ ____
11. 5 and 15 ____ ____ ____ ____
12. 5 and 20 ____ ____ ____ ____
13. 50 and 150 ____ ____ ____ ____
14. 100 and 200 ____ ____ ____ ____
15. 500 and 1,000 ____ ____ ____ ____

— The numbers below are each common multiples of three other numbers. Name those numbers.

16. 6, 12, 18, 24, 30 ____ ____ ____
17. 15, 30, 45, 60, 75 ____ ____ ____
18. 14, 28, 42, 56, 70 ____ ____ ____

# Problem Test 1

**1.** Last Halloween the four Hall children collected 372 pieces of candy altogether. If they shared the candy equally, how many pieces did each child get? _____

**2.** Mrs. Shaw's class contributed $14.00 for a party. They spent $2.80 for soda, $2.20 for cookies, $2.40 for cupcakes, and $4.95 for her gift. How much money was left? _____

**3.** Sally's mathematics test marks in one month were 82, 74, 96, and 88. What was her average mark? _____

**4.** Seven women in a cafeteria made 95 ham, 85 bologna, 70 peanut butter, and 128 roast beef sandwiches. If they shared the work equally, each woman made _____ sandwiches.

**5.** Ed earns $.75 an hour doing small jobs. Last month he worked 18 hours. How much did he earn? _____

**6.** On a 4-day trip, Mr. Warner traveled 364 miles, 412 miles, 387 miles, and 401 miles. What was the average number of miles he traveled per day? _____

**7.** The Davis School bought 325 mathematics books at a cost of $3.40 each. What was the total cost? _____

**8.** If 33 pupils wish to share equally the cost of $24.75 for a bus trip, each pupil should pay _____.

**9.** The planet Mars makes one complete orbit around the sun in 687 Earth days. The planet Mercury takes 88 Earth days. Mars takes _____ more days to complete its orbit.

**10.** Mrs. Fay bought dress material for $2.78, a pattern for $.95, a zipper for $.49, thread for $.30, and buttons for $.60. In all, Mrs. Fay spent _____.

| | |
|---|---|
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |
| 7 | 8 |
| 9 | 10 |

Number correct: _____. Date: _____________ _____, _________.
Write your score in the Problem Test Record on page 160. Fill in the first bar on the graph form for Problem Tests, page 160.

## Review

**1.**

$$\begin{array}{r} 682\\ 754\\ 863\\ 297\\ 846\\ +320\\ \hline \end{array} \qquad \begin{array}{r} 364\\ 287\\ 905\\ 46\\ 937\\ +\ 83\\ \hline \end{array} \qquad \begin{array}{r} \$5.64\\ .29\\ 9.30\\ 8.76\\ .94\\ +2.38\\ \hline \end{array}$$

**2.**

$$\begin{array}{r} 468\\ -197\\ \hline \end{array} \qquad \begin{array}{r} 900\\ -286\\ \hline \end{array} \qquad \begin{array}{r} 4{,}063\\ -1{,}985\\ \hline \end{array}$$

**3.**

$$\begin{array}{r} 29\\ \times 86\\ \hline \end{array} \qquad \begin{array}{r} 425\\ \times 87\\ \hline \end{array} \qquad \begin{array}{r} \$5.46\\ \times 33\\ \hline \end{array}$$

**4.** $7\overline{)617}$ $\qquad 6\overline{)3{,}216}$ $\qquad 8\overline{)3{,}256}$

**5.** $21\overline{)672}$ $\qquad 43\overline{)1{,}462}$ $\qquad 73\overline{)4{,}526}$

## Progress Test 1

**1.**

$$\begin{array}{r} \$46.83\\ 29.76\\ 43.28\\ 29.67\\ +48.34\\ \hline \end{array}$$

**2.**

$$\begin{array}{r} \$468.78\\ -95.69\\ \hline \end{array}$$

**3.**

$$\begin{array}{r} 705\\ \times 79\\ \hline \end{array}$$

**4.** $23\overline{)782}$

**5.** What decimal numeral names the same number as $42_{five}$? ______

**6.** What decimal numeral names the same number as MCMLXIII? ______

**7.** If set A = {11, 13, 15, 17} and set B = {10, 12, 14, 16}, list the members of $A \cup B$. ______________________________

**8.** If set C = {0, 3, 6, 9, 12, 15, 18} and set D = {6, 12, 18, 24}, list the members of $C \cap D$. ______________

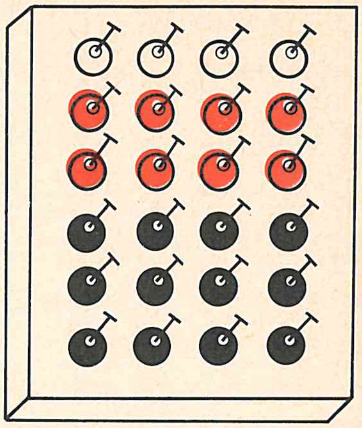
— If $n$ stands for any whole number, list the members of the solution set for each sentence below.

**9.** $n \times 8 < 48$ ____________________

**10.** $n \times 8 \leq 48$ ____________________

Number correct: ______. Date: ______________ ____, ________.
Write your score on the Progress Test Record on page 160. Fill in the first bar in the Progress Test graph form on page 160.

# Fractional numbers



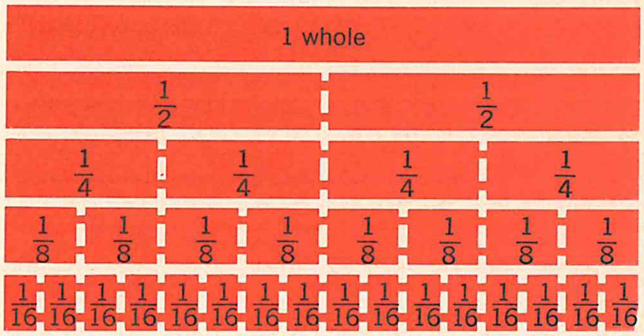
**1.** In the number pair (4, 24) the 24 tells how many disks there are on this board. The 4 tells how many disks are white. What number tells how many disks are colored? ______ tells how many are black? ______

**2.** We can use a **fractional number** to tell the part of the set that is white. The symbol $\frac{4}{24}$ is called a **fraction.** It names a fractional number.

The number 4 shown in the fraction is the **numerator** and the number 24 is the **denominator.**

What fraction names the part of the set that is colored? _____ the part that is black? _____

Use the diagram at the right to answer the following exercises.



**3.** 2 halves make _____ whole

2 fourths make _____ half

2 eighths make _____ fourth

2 sixteenths make _____ eighth

Name the missing numerators or denominators.

| | a | b | c | d | e | f |
|---|---|---|---|---|---|---|
| **4.** | $\frac{1}{2} = \frac{\quad}{4}$ | $\frac{1}{4} = \frac{\quad}{8}$ | $\frac{1}{2} = \frac{\quad}{8}$ | $\frac{3}{4} = \frac{\quad}{8}$ | $\frac{1}{8} = \frac{\quad}{16}$ | $\frac{1}{2} = \frac{\quad}{16}$ |
| **5.** | $\frac{4}{16} = \frac{\quad}{4}$ | $\frac{6}{16} = \frac{\quad}{8}$ | $\frac{8}{16} = \frac{\quad}{2}$ | $\frac{10}{16} = \frac{\quad}{8}$ | $\frac{12}{16} = \frac{\quad}{4}$ | $\frac{6}{8} = \frac{\quad}{4}$ |
| **6.** | $\frac{3}{\quad} = \frac{6}{8}$ | $\frac{2}{16} = \frac{1}{\quad}$ | $\frac{6}{\quad} = \frac{3}{8}$ | $\frac{12}{\quad} = \frac{3}{4}$ | $\frac{10}{16} = \frac{5}{\quad}$ | $\frac{7}{\quad} = \frac{14}{16}$ |

**7.** Is $\frac{1}{4}$ another name for $\frac{4}{16}$? _____ When you express $\frac{4}{16}$ as $\frac{1}{4}$, you are naming $\frac{4}{16}$ in lowest terms.

# Naming a fractional part

**1.** Tom earned 60 cents. George earned 80 cents. To find what part Tom's earnings were of George's, divide 60 by 80. In lowest terms, $\frac{60}{80} =$ ____, so Tom earned ____ as much as George.

**2.** Mary wanted to buy 24 inches of toweling, which sold by the yard. What part of a yard did she want? To find what part 24 inches is of 36 inches, divide 24 by 36. $\frac{24}{36} =$ ____ Mary wanted ____ of a yard.

**3.** Grace worked 45 minutes. She was paid by the hour. What part of an hour did she work? $\frac{45}{60} =$ ____ Grace worked ____ of an hour.

**4.** Use a fraction in lowest terms to name each fractional part.

| NUMBER OF CENTS | PART OF $1 |
|---|---|
| 1¢ | $\frac{1}{100}$ |
| 2¢ | $\frac{2}{100} = \frac{1}{50}$ |
| 5¢ | |
| 10¢ | |
| 25¢ | |
| 50¢ | |
| 75¢ | |

| NUMBER OF INCHES | PART OF 1 YARD |
|---|---|
| 1 in. | |
| 3 in. | |
| 6 in. | |
| 9 in. | |
| 12 in. | |
| 18 in. | |
| 27 in. | |

| NUMBER OF MINUTES | PART OF 1 HOUR |
|---|---|
| 1 min. | |
| 10 min. | |
| 15 min. | |
| 20 min. | |
| 30 min. | |
| 45 min. | |
| 50 min. | |

**5.** Use a fraction in lowest terms to show what part the first number is of the second number.

| | |
|---|---|
| 4, 8 | $\frac{4}{8} = \frac{1}{2}$ |
| 3, 9 | |
| 4, 12 | |
| 8, 12 | |
| 9, 12 | |
| 12, 16 | |

| | |
|---|---|
| 2, 3 | |
| 3, 4 | |
| 5, 7 | |
| 7, 8 | |
| 11, 15 | |
| 9, 16 | |

| | |
|---|---|
| 3, 18 | |
| 4, 18 | |
| 6, 18 | |
| 9, 18 | |
| 12, 18 | |
| 16, 18 | |

| | |
|---|---|
| 3, 24 | |
| 4, 24 | |
| 8, 24 | |
| 10, 24 | |
| 16, 24 | |
| 20, 24 | |

# Equivalent fractions

**1.** Multiply both the numerator and the denominator of $\frac{1}{3}$ by 2; by 3; by 4; by 5.

$\frac{2 \times 1}{2 \times 3} = \frac{\quad}{6}$  $\frac{3 \times 1}{3 \times 3} = \frac{\quad}{9}$

$\frac{4 \times 1}{4 \times 3} = \frac{4}{\quad}$  $\frac{5 \times 1}{5 \times 3} = \frac{5}{\quad}$

**2.** Divide both the numerator and the denominator of these fractions, as shown.

$\frac{5 \div 5}{20 \div 5} = \underline{\qquad}$  $\frac{4 \div 4}{16 \div 4} = \underline{\qquad}$

$\frac{3 \div 3}{12 \div 3} = \underline{\qquad}$  $\frac{2 \div 2}{8 \div 2} = \underline{\qquad}$

The fractions shown in each set below are **equivalent fractions.**

$\left\{\frac{1}{3}, \frac{2}{6}, \frac{3}{9}, \frac{4}{12}, \frac{5}{15}\right\}$  $\left\{\frac{1}{4}, \frac{2}{8}, \frac{3}{12}, \frac{4}{16}, \frac{5}{20}\right\}$

**3.** To find other names for the number named by $4\frac{1}{5}$, you can think:

- $4\frac{1}{5} = 4 + \frac{1}{5}$
- $4\frac{1}{5} = 4 + \frac{2}{10}$, or $4\frac{2}{10}$
- $4\frac{1}{5} = 4 + \frac{3}{15}$, or $4\frac{3}{15}$

The names above are called **mixed forms.** Name two other mixed forms that name the same number as $4\frac{1}{5}$. $\underline{\qquad}$ $\underline{\qquad}$

**4.** In the set shown below, name the next three mixed forms that name the same number.

$\left\{5\frac{1}{2}, 5\frac{2}{4}, \underline{\qquad}, \underline{\qquad}, \underline{\qquad}\right\}$

— Complete each of the following to show an equivalent fraction or a mixed form.

| | a | b |
|---|---|---|
| **5.** | $\frac{2}{3} = \frac{\quad}{15}$ | $\frac{5}{6} = \frac{\quad}{12}$ |
| **6.** | $\frac{3}{4} = \frac{18}{\quad}$ | $\frac{7}{8} = \frac{21}{\quad}$ |
| **7.** | $\frac{4}{9} = \frac{20}{\quad}$ | $\frac{3}{10} = \frac{\quad}{70}$ |
| **8.** | $\frac{14}{20} = \frac{\quad}{10}$ | $\frac{15}{36} = \frac{5}{\quad}$ |
| **9.** | $\frac{16}{20} = \frac{4}{\quad}$ | $\frac{40}{60} = \frac{\quad}{3}$ |
| **10.** | $\frac{7}{11} = \frac{35}{\quad}$ | $\frac{6}{7} = \frac{\quad}{56}$ |
| **11.** | $\frac{9}{20} = \frac{\quad}{100}$ | $\frac{3}{5} = \frac{27}{\quad}$ |
| **12.** | $\frac{7}{30} = \frac{\quad}{150}$ | $\frac{100}{500} = \frac{\quad}{10}$ |
| **13.** | $\frac{20}{70} = \frac{4}{\quad}$ | $\frac{8}{13} = \frac{40}{\quad}$ |
| **14.** | $\frac{72}{100} = \frac{\quad}{25}$ | $\frac{15}{60} = \frac{1}{\quad}$ |
| **15.** | $2\frac{1}{9} = 2\frac{7}{\quad}$ | $6\frac{9}{12} = 6\frac{\quad}{4}$ |
| **16.** | $8\frac{90}{120} = 8\frac{\quad}{20}$ | $4\frac{3}{7} = 4\frac{150}{\quad}$ |
| **17.** | $1\frac{11}{20} = 1\frac{\quad}{100}$ | $5\frac{200}{400} = 5\frac{\quad}{8}$ |
| **18.** | $7\frac{5}{14} = 7\frac{30}{\quad}$ | $3\frac{24}{36} = 3\frac{2}{\quad}$ |

# Naming fractional numbers in lowest terms

Set X is the set of factors of 4. Set Y is the set of factors of 9. X ∩ Y shows that 1 is the only member in both sets.

$X = \{1, 4\}$    $Y = \{1, 9\}$    $X \cap Y = \{1\}$

The fraction $\frac{4}{9}$ is in **lowest terms** because 4 and 9 have no **common factor** except 1.

**1.** To discover if $\frac{16}{24}$ is in lowest terms, first find the factors of the numerator and the denominator.

In set A show the factors of 16. In set B show the factors of 24. Then show the members of A ∩ B.

$A = \{\qquad\qquad\qquad\}$

$B = \{\qquad\qquad\qquad\qquad\qquad\}$

$A \cap B = \{\qquad\qquad\qquad\}$

**2.** What is the greatest common factor of 16 and 24? ______

**3.** Divide the numerator and the denominator by the greatest common factor.

$$\frac{16}{24} = \frac{16 \div 8}{24 \div 8} = \underline{\qquad}$$

**4.** The fraction $\frac{36}{24}$ may be named by:

$$\frac{18}{\quad}, \frac{\quad}{8}, \frac{9}{\quad}, \frac{\quad}{4}, \frac{3}{\quad}, \text{ or } 1\tfrac{1}{2}$$

When $\frac{36}{24}$ is expressed as $\frac{3}{2}$, or $1\frac{1}{2}$, it is named in lowest terms.

— Name in lowest terms, as numerals for whole numbers, or as mixed forms.

| | a | b |
|---|---|---|
| **5.** | $\frac{18}{30} =$ | $\frac{13}{10} =$ |
| **6.** | $\frac{18}{3} =$ | $\frac{28}{40} =$ |
| **7.** | $\frac{16}{7} =$ | $\frac{100}{5} =$ |
| **8.** | $\frac{48}{3} =$ | $\frac{17}{4} =$ |
| **9.** | $\frac{16}{32} =$ | $\frac{42}{6} =$ |
| **10.** | $\frac{19}{5} =$ | $\frac{60}{75} =$ |
| **11.** | $\frac{28}{35} =$ | $\frac{15}{8} =$ |
| **12.** | $\frac{60}{72} =$ | $5\frac{18}{30} =$ |
| **13.** | $2\frac{16}{10} =$ | $8\frac{9}{15} =$ |
| **14.** | $6\frac{4}{3} =$ | $1\frac{2}{20} =$ |
| **15.** | $5\frac{4}{4} =$ | $3\frac{12}{20} =$ |
| **16.** | $7\frac{30}{23} =$ | $9\frac{29}{29} =$ |
| **17.** | $4\frac{80}{40} =$ | $2\frac{50}{75} =$ |
| **18.** | $3\frac{28}{36} =$ | $6\frac{96}{100} =$ |

# Adding and subtracting fractional numbers

The number sentences at the right show how to add and subtract fractional numbers named by **like fractions** having a **common denominator.**

**A** $\frac{2}{6} + \frac{3}{6} = \frac{2+3}{6} = \frac{5}{6}$

**B** $\frac{5}{7} - \frac{3}{7} = \frac{5-3}{7} = \frac{2}{7}$

– Complete the addition and subtraction sentences below. Express your answers in lowest terms.

| | **a** | **b** |
|---|---|---|
| **1.** | $\frac{5}{8} + \frac{1}{8} =$ | $\frac{7}{10} - \frac{3}{10} =$ |
| **2.** | $\frac{2}{9} + \frac{7}{9} =$ | $\frac{13}{15} - \frac{7}{15} =$ |
| **3.** | $\frac{17}{20} - \frac{5}{20} =$ | $\frac{6}{25} + \frac{9}{25} =$ |
| **4.** | $\frac{18}{30} - \frac{9}{30} =$ | $\frac{7}{5} + \frac{3}{5} =$ |
| **5.** | $\frac{22}{35} + \frac{3}{35} =$ | $\frac{40}{50} - \frac{12}{50} =$ |
| **6.** | $\frac{29}{32} - \frac{17}{32} =$ | $\frac{81}{100} + \frac{15}{100} =$ |
| **7.** | $\frac{15}{4} + \frac{5}{4} =$ | $\frac{13}{16} - \frac{9}{16} =$ |
| **8.** | $\frac{23}{24} - \frac{5}{24} =$ | $\frac{3}{36} + \frac{15}{36} =$ |
| **9.** | $\frac{7}{40} + \frac{17}{40} =$ | $\frac{57}{100} - \frac{23}{100} =$ |
| **10.** | $\frac{65}{50} - \frac{15}{50} =$ | $\frac{7}{18} + \frac{17}{18} =$ |

# Least common denominators

**1.** Set Q is a set of multiples of ____, and set R is a set of multiples of ____.

$Q = \{4, 8, 12, 16, 20, 24\}$

$R = \{3, 6, 9, 12, 15, 18, 21, 24\}$

$Q \cap R = \{ \qquad \}$

The common multiples of 4 and 3 are ____ and ____.

The **least common multiple** of 4 and 3 is ____.

**2.** Read these names for $\frac{1}{4}$ and $\frac{1}{3}$.

$\left\{\frac{1}{4}, \frac{2}{8}, \frac{3}{12}, \frac{4}{16}, \frac{5}{20}, \frac{6}{24}\right\}$

$\left\{\frac{1}{3}, \frac{2}{6}, \frac{3}{9}, \frac{4}{12}, \frac{5}{15}, \frac{6}{18}, \frac{7}{21}, \frac{8}{24}\right\}$

What two fractions equivalent to $\frac{1}{4}$ and $\frac{1}{3}$ have a common denominator?

____ ____ and ____ ____

What is the least common denominator of $\frac{1}{4}$ and $\frac{1}{3}$? ____

**3.** Complete these sets to show equivalent fractions.

$\left\{\frac{2}{3}, \frac{\_\_}{6}, \frac{\_\_}{9}, \frac{\_\_}{12}, \frac{\_\_}{15}, \frac{\_\_}{18}\right\}$

$\left\{\frac{1}{4}, \frac{2}{\_\_}, \frac{3}{\_\_}, \frac{4}{\_\_}, \frac{5}{\_\_}, \frac{6}{\_\_}\right\}$

$\left\{\frac{3}{5}, \frac{6}{\_\_}, \frac{9}{\_\_}, \frac{12}{\_\_}, \frac{15}{\_\_}, \frac{18}{\_\_}\right\}$

$\left\{\frac{4}{6}, \frac{\_\_}{12}, \frac{\_\_}{18}, \frac{\_\_}{24}, \frac{\_\_}{30}, \frac{\_\_}{36}\right\}$

To add or subtract fractional numbers named by unlike fractions, name the fractions so that they will have the least common denominator.

| **A** | **B** |
|---|---|
| $\frac{1}{2} + \frac{1}{3} = n$ | $\frac{3}{8} - \frac{1}{4} = n$ |
| $\frac{3}{6} + \frac{2}{6} = \frac{5}{6}$ | $\frac{3}{8} - \frac{2}{8} = \frac{1}{8}$ |

Solve these sentences.

**4.** $\frac{2}{6} + \frac{1}{2} =$

**5.** $\frac{7}{8} - \frac{3}{4} =$

**6.** $\frac{3}{4} + \frac{1}{6} =$

**7.** $\frac{4}{5} - \frac{1}{2} =$

Here is another way to add and subtract fractional numbers.

| **A** | **B** |
|---|---|
| $\frac{2}{3} = \frac{8}{12}$ | $\frac{1}{2} = \frac{3}{6}$ |
| $+\frac{1}{4} = \frac{3}{12}$ | $-\frac{1}{3} = \frac{2}{6}$ |
| $\frac{11}{12}$ | $\frac{1}{6}$ |

Find the answers.

**8.** $\begin{array}{r} \frac{1}{2} \\ +\frac{3}{4} \\ \hline \end{array}$ $\qquad$ $\begin{array}{r} \frac{3}{8} \\ +\frac{1}{4} \\ \hline \end{array}$

**9.** $\begin{array}{r} \frac{2}{3} \\ -\frac{1}{6} \\ \hline \end{array}$ $\qquad$ $\begin{array}{r} \frac{3}{5} \\ -\frac{1}{10} \\ \hline \end{array}$

**10.** $\begin{array}{r} \frac{3}{4} \\ +\frac{1}{8} \\ \hline \end{array}$ $\qquad$ $\begin{array}{r} \frac{5}{8} \\ -\frac{3}{16} \\ \hline \end{array}$

# Adding and subtracting unlike fractions

— Find the answers. Express them in lowest terms.

| | a | b | c |
|---|---|---|---|
| **1.** | $\begin{array}{r} \frac{3}{4} \\ +\frac{1}{12} \\ \hline \end{array}$ | $\begin{array}{r} \frac{9}{10} \\ -\frac{1}{5} \\ \hline \end{array}$ | $\begin{array}{r} \frac{2}{3} \\ +\frac{3}{5} \\ \hline \end{array}$ |
| **2.** | $\begin{array}{r} \frac{8}{9} \\ -\frac{1}{2} \\ \hline \end{array}$ | $\begin{array}{r} \frac{3}{15} \\ +\frac{2}{5} \\ \hline \end{array}$ | $\begin{array}{r} \frac{7}{8} \\ -\frac{2}{3} \\ \hline \end{array}$ |
| **3.** | $\begin{array}{r} \frac{3}{8} \\ +\frac{5}{6} \\ \hline \end{array}$ | $\begin{array}{r} \frac{5}{6} \\ -\frac{1}{4} \\ \hline \end{array}$ | $\begin{array}{r} \frac{9}{10} \\ -\frac{1}{4} \\ \hline \end{array}$ |
| **4.** | $\begin{array}{r} \frac{1}{4} \\ +\frac{2}{5} \\ \hline \end{array}$ | $\begin{array}{r} \frac{6}{7} \\ -\frac{2}{3} \\ \hline \end{array}$ | $\begin{array}{r} \frac{1}{4} \\ +\frac{1}{6} \\ \hline \end{array}$ |
| **5.** | $\begin{array}{r} \frac{5}{8} \\ -\frac{1}{12} \\ \hline \end{array}$ | $\begin{array}{r} \frac{2}{9} \\ +\frac{5}{12} \\ \hline \end{array}$ | $\begin{array}{r} \frac{3}{4} \\ -\frac{2}{5} \\ \hline \end{array}$ |
| **6.** | $\begin{array}{r} \frac{3}{8} \\ +\frac{1}{6} \\ \hline \end{array}$ | $\begin{array}{r} \frac{3}{10} \\ +\frac{1}{6} \\ \hline \end{array}$ | $\begin{array}{r} \frac{7}{8} \\ -\frac{3}{10} \\ \hline \end{array}$ |
| **7.** | $\begin{array}{r} \frac{8}{9} \\ -\frac{5}{6} \\ \hline \end{array}$ | $\begin{array}{r} \frac{7}{8} \\ +\frac{6}{16} \\ \hline \end{array}$ | $\begin{array}{r} \frac{2}{9} \\ +\frac{5}{6} \\ \hline \end{array}$ |

# Mixed forms in addition and subtraction

The examples at the right show how to add and subtract fractional numbers named by mixed forms.

Find the answers. Express them in lowest terms.

| A | B |
|---|---|
| $\begin{array}{rl} 1\frac{3}{4} = & 1\frac{6}{8} \\ +2\frac{7}{8} = & 2\frac{7}{8} \\ \hline & 3\frac{13}{8}, \text{ or } 4\frac{5}{8} \end{array}$ | $\begin{array}{rll} 5\frac{3}{4} = & 5\frac{9}{12} = & 4\frac{21}{12} \\ -2\frac{5}{6} = & 2\frac{10}{12} = & 2\frac{10}{12} \\ \hline & & 2\frac{11}{12} \end{array}$ |

| | a | b | c |
|---|---|---|---|
| **1.** | $\begin{array}{r} 3\frac{5}{12} \\ +4\frac{3}{12} \\ \hline \end{array}$ | $\begin{array}{r} 7\frac{9}{10} \\ -3\frac{3}{10} \\ \hline \end{array}$ | $\begin{array}{r} 8\frac{7}{8} \\ -2\frac{1}{8} \\ \hline \end{array}$ |
| **2.** | $\begin{array}{r} 5\frac{6}{7} \\ +2\frac{5}{7} \\ \hline \end{array}$ | $\begin{array}{r} 1\frac{4}{15} \\ +7\frac{2}{5} \\ \hline \end{array}$ | $\begin{array}{r} 8\frac{7}{12} \\ -5\frac{1}{3} \\ \hline \end{array}$ |
| **3.** | $\begin{array}{r} 7\frac{2}{3} \\ +2\frac{3}{4} \\ \hline \end{array}$ | $\begin{array}{r} 10\frac{3}{8} \\ -6\frac{5}{12} \\ \hline \end{array}$ | $\begin{array}{r} 15\frac{1}{4} \\ -3\frac{5}{6} \\ \hline \end{array}$ |
| **4.** | $\begin{array}{r} 5\frac{3}{4} \\ +2\frac{7}{10} \\ \hline \end{array}$ | $\begin{array}{r} 8\frac{2}{5} \\ +7\frac{3}{4} \\ \hline \end{array}$ | $\begin{array}{r} 9\frac{1}{6} \\ -3\frac{5}{9} \\ \hline \end{array}$ |
| **5.** | $\begin{array}{r} 11\frac{2}{9} \\ -4\frac{7}{12} \\ \hline \end{array}$ | $\begin{array}{r} 8\frac{3}{10} \\ +3\frac{5}{6} \\ \hline \end{array}$ | $\begin{array}{r} 5\frac{2}{7} \\ +4\frac{3}{5} \\ \hline \end{array}$ |
| **6.** | $\begin{array}{r} 14\frac{3}{4} \\ -6\frac{5}{6} \\ \hline \end{array}$ | $\begin{array}{r} 8\frac{1}{7} \\ -7\frac{2}{3} \\ \hline \end{array}$ | $\begin{array}{r} 6\frac{3}{8} \\ +7\frac{2}{3} \\ \hline \end{array}$ |

# Practice

Solve these sentences and express the answers in lowest terms. The first one is done for you.

| | a | b | c |
|---|---|---|---|
| **1.** | $2\frac{2}{3} - n = 1\frac{1}{2}$<br>$2\frac{2}{3} = 2\frac{4}{6}$<br>$\underline{-\ 1\frac{1}{2} = 1\frac{3}{6}}$<br>$1\frac{1}{6}$ | $6\frac{3}{4} + n = 9\frac{5}{6}$ | $4\frac{3}{5} + n = 7\frac{9}{10}$ |
| **2.** | $10\frac{3}{4} - n = 4\frac{1}{2}$ | $8\frac{2}{5} - n = 3\frac{1}{4}$ | $1\frac{5}{6} + n = 5\frac{3}{4}$ |
| **3.** | $8\frac{3}{8} + n = 12\frac{1}{6}$ | $7\frac{1}{2} - n = 4\frac{2}{5}$ | $12\frac{1}{4} - n = 3\frac{1}{10}$ |
| **4.** | $3\frac{2}{7} + n = 6\frac{1}{2}$ | $n - 2\frac{5}{8} = 16$ | $n - 2\frac{2}{3} = 2\frac{1}{4}$ |
| **5.** | $n + 8\frac{1}{9} = 11\frac{1}{2}$ | $n + 3\frac{2}{5} = 7\frac{2}{3}$ | $n - 5\frac{1}{6} = 9\frac{3}{4}$ |

# Problem solving

**1.** Harry weighs 40 pounds. His sister Joyce weighs 80 pounds. What part of Joyce's weight is Harry's? _____

**2.** If cupcakes sell for $1.00 a dozen, what part of a dozen would Joan get for $.75? _____

**3.** Dick can rent a riding horse for $.90 an hour. What part of an hour can he ride for $.60? _____

**4.** A large bar of chocolate weighs 12 ounces. What part of a pound does it weigh? _____

**5.** The length of one metal pipe is $3\frac{1}{2}$ feet and the length of another metal pipe is $4\frac{1}{4}$ feet. What is the length of the two pipes, placed end to end? _____

**6.** From a 10-yard bolt of material, Mrs. Carter bought $3\frac{3}{4}$ yards. How many yards of material were left on the bolt? _____

**7.** Mrs. Barton bought $3\frac{3}{4}$ pounds of chopped beef and a $5\frac{1}{2}$-pound leg of lamb. How many pounds of meat did she have? _____

**8.** Mary had $4\frac{1}{4}$ yards of ribbon. She used $1\frac{2}{3}$ yards to tie a gift package. How many yards of ribbon did she have left? _____

1

2

3

4

5

6

7

8

# Tenths, hundredths, and thousandths named by decimals

| | | |
|---|---|---|
| $1\frac{6}{10} = 1.6$<br>The *tenths place* is the first place to the right of the ones place. | $1\frac{60}{100} = 1.60$<br>The *hundredths place* is the second place to the right of the ones place. | $1\frac{600}{1,000} = 1.600$<br>The *thousandths place* is the third place to the right of the ones place. |

— Complete the following tables.

1.

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{1}{10}$ | $\frac{2}{10}$ | $\frac{3}{10}$ | $\frac{4}{10}$ | $\frac{5}{10}$ | $\frac{6}{10}$ | | | $\frac{9}{10}$ | $\frac{10}{10}$ | $1\frac{1}{10}$ | | $1\frac{3}{10}$ | | | $1\frac{6}{10}$ |
| 0.1 | 0.2 | 0.3 | | | 0.6 | 0.7 | 0.8 | | 1.0 | 1.1 | 1.2 | | 1.4 | 1.5 | |

2.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{3}{100}$ | $\frac{6}{100}$ | | $\frac{12}{100}$ | $\frac{15}{100}$ | | | $\frac{24}{100}$ | $\frac{27}{100}$ | $\frac{30}{100}$ | | | $\frac{39}{100}$ | |
| | | 0.09 | | | 0.18 | 0.21 | | | | 0.33 | 0.36 | | 0.42 |

3.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| $4\frac{15}{1,000}$ | | $4\frac{25}{1,000}$ | $4\frac{30}{1,000}$ | | $4\frac{40}{1,000}$ | $4\frac{45}{1,000}$ | | $4\frac{55}{1,000}$ | $4\frac{60}{1,000}$ | |
| 4.015 | 4.020 | | | 4.035 | | | 4.050 | | | 4.065 |

— What is the pattern? Complete each set shown below.

4. {6.6, 6.4, 6.2, ____, ____, ____, ____, 5.2, ____, ____, ____, ____, 4.2}

5. {3.5, 4.0, 4.5, ____, ____, ____, ____, 7.0, ____, ____, ____, ____, 9.5}

6. {0.8, 1.3, 1.8, ____, ____, ____, ____, 4.3, ____, ____, ____, ____, 6.8}

7. {0.82, 0.84, 0.86, ____, ____, ____, 0.94, ____, ____, ____, 1.02}

8. {2.75, 2.80, 2.85, ____, ____, ____, 3.05, ____, ____, ____, 3.25}

9. {4.25, 4.50, 4.75, ____, ____, ____, 5.75, ____, ____, ____, 6.75}

10. {1.000, 0.999, 0.998, ____, ____, ____, ____, ____, ____, ____}

11. {5.003, 5.005, 5.007, ____, ____, ____, ____, ____, ____, ____}

12. {8.065, 8.070, 8.075, ____, ____, ____, ____, ____, ____, ____}

# Practice with decimals

— Name each as a decimal.

| | a | | b | |
|---|---|---|---|---|
| **1.** | $\frac{7}{100}$ | ______ | $\frac{16}{1,000}$ | ______ |
| **2.** | $\frac{3}{1,000}$ | ______ | $6\frac{2}{10}$ | ______ |
| **3.** | $5\frac{9}{100}$ | ______ | $7\frac{31}{1,000}$ | ______ |
| **4.** | $2\frac{21}{1,000}$ | ______ | $4\frac{101}{1,000}$ | ______ |
| **5.** | $8\frac{5}{1,000}$ | ______ | $13\frac{12}{100}$ | ______ |

— Name each as a fraction or mixed form.

| | a | | b | |
|---|---|---|---|---|
| **6.** | 5.7 | ______ | 0.9 | ______ |
| **7.** | 0.37 | ______ | 0.56 | ______ |
| **8.** | 4.08 | ______ | 16.04 | ______ |
| **9.** | 0.067 | ______ | 0.005 | ______ |
| **10.** | 9.999 | ______ | 0.020 | ______ |

— Using digits, write the decimal name for each of the following.

| | a | | b | |
|---|---|---|---|---|
| **11.** | thirty-two thousandths | ______ | seventy-one and one thousandth | ______ |
| **12.** | fifteen hundredths | ______ | two hundred seventy thousandths | ______ |
| **13.** | twelve and five tenths | ______ | fifty and twenty-two hundredths | ______ |
| **14.** | one and one hundredth | ______ | one hundred and one thousandth | ______ |
| **15.** | twenty-two thousandths | ______ | seventy and seventy thousandths | ______ |
| **16.** | ninety and seven tenths | ______ | five hundred and five hundredths | ______ |
| **17.** | forty thousandths | ______ | two hundred ten thousandths | ______ |
| **18.** | eight hundredths | ______ | sixty and one hundred one thousandths | ______ |
| **19.** | fifty and seven tenths | ______ | six and sixty-six hundredths | ______ |
| **20.** | two and one hundredth | ______ | seven hundred one thousandths | ______ |

# Rounding decimals

— Complete this table.

| | ROUND TO THE NEAREST: | | | | |
|---|---|---|---|---|---|
| DECIMAL | hundred | ten | one | tenth | hundredth |
| 75.468 | | | | | |
| 23.154 | | | | | |
| 134.521 | | | | | |
| 493.848 | | | | | |
| 50.146 | | | | | |
| 549.802 | | | | | |
| 861.105 | | | | | |
| 354.264 | | | | | |
| 945.545 | | | | | |
| 49.367 | | | | | |
| 193.391 | | | | | |
| 246.864 | | | | | |
| 90.543 | | | | | |
| 3.456 | | | | | |
| 7.539 | | | | | |
| 164.828 | | | | | |
| 776.670 | | | | | |
| 384.927 | | | | | |
| 86.420 | | | | | |
| 49.909 | | | | | |
| 144.456 | | | | | |
| 38.928 | | | | | |
| 299.987 | | | | | |
| 748.555 | | | | | |

# Review

**1.**
$$\begin{array}{r} 587 \\ 642 \\ 353 \\ +910 \\ \hline \end{array} \qquad \begin{array}{r} 4{,}550 \\ 9{,}669 \\ 5{,}372 \\ +4{,}015 \\ \hline \end{array} \qquad \begin{array}{r} 789 \\ 676 \\ 543 \\ 493 \\ +789 \\ \hline \end{array} \qquad \begin{array}{r} \$4.76 \\ 9.09 \\ .75 \\ 6.40 \\ +.80 \\ \hline \end{array} \qquad \begin{array}{r} \$17.85 \\ 9.30 \\ 20.05 \\ .75 \\ +16.85 \\ \hline \end{array}$$

**2.**
$$\begin{array}{r} 7{,}483 \\ -3{,}535 \\ \hline \end{array} \qquad \begin{array}{r} 9{,}000 \\ -6{,}541 \\ \hline \end{array} \qquad \begin{array}{r} 7{,}612 \\ -3{,}279 \\ \hline \end{array} \qquad \begin{array}{r} \$31.14 \\ -17.86 \\ \hline \end{array} \qquad \begin{array}{r} \$50.10 \\ -37.95 \\ \hline \end{array}$$

**3.**
$$\begin{array}{r} 37 \\ \times 79 \\ \hline \end{array} \qquad \begin{array}{r} 284 \\ \times 36 \\ \hline \end{array} \qquad \begin{array}{r} 123 \\ \times 89 \\ \hline \end{array} \qquad \begin{array}{r} 509 \\ \times 86 \\ \hline \end{array} \qquad \begin{array}{r} 804 \\ \times 607 \\ \hline \end{array}$$

**4.**
$$35\overline{)1{,}260} \qquad 25\overline{)1{,}475} \qquad 34\overline{)1{,}428} \qquad 62\overline{)1{,}688}$$

**5.**
$$\begin{array}{r} 2\frac{3}{4} \\ +5\frac{2}{3} \\ \hline \end{array} \qquad \begin{array}{r} 8\frac{7}{8} \\ -4\frac{1}{2} \\ \hline \end{array} \qquad \begin{array}{r} 6\frac{2}{3} \\ +8\frac{3}{4} \\ \hline \end{array} \qquad \begin{array}{r} 9 \\ -3\frac{5}{8} \\ \hline \end{array}$$

— Name as decimals.

**6.** $\frac{3}{10} =$ ______ $\frac{7}{100} =$ ______ $\frac{73}{100} =$ ______ $\frac{5}{1{,}000} =$ ______ $\frac{56}{1{,}000} =$ ______

— Name as fractions.

**7.** 0.7 = ______ 0.09 = ______ 0.37 = ______ 0.067 = ______ 0.475 = ______

**8.** $92 + n = 112$ $n =$ ______

**9.** $74 - n = 48$ $n =$ ______

**10.** $60 \times n = 720$ $n =$ ______

**11.** $84 \div n = 21$ $n =$ ______

WORK SPACE

# Problem Test 2

**1.** In 1950 the population of Yuma, Arizona was 9,145. The population of Prescott, Arizona was 6,764. How many more people lived in Yuma in 1950? ________

**2.** In the last 6 months, Mrs. Hart used 68, 73, 67, 78, 65, and 69 quarts of milk. She used an average of _____ quarts per month.

**3.** Mrs. Henry used $1\frac{1}{3}$ dozen eggs in one week and $2\frac{1}{4}$ dozen the next week. In two weeks she used _____ dozen.

**4.** America's first astronaut averaged 292 miles per minute. About how far did he travel in an hour? ________

**5.** If 672 pieces of candy are packed in boxes with 42 pieces in each box, _____ boxes are needed.

**6.** Bill's father bought him a sport jacket for $17.95, a hat for $3.99, a shirt for $3.69, and a pair of gloves for $4.50. How much money did he spend in all? ________

**7.** If $2\frac{7}{8}$ yards of rope are cut from a length of rope measuring $18\frac{1}{4}$ yards, _____ yards of rope will be left.

**8.** If butter cookies sell for $1.80 a pound, Ann will get _____ pound for $1.20.

**9.** A Scout troop hiked for $2\frac{7}{10}$ miles, and then continued on for $3\frac{1}{5}$ miles after a stop for refreshments. How many miles did the troop hike in all? _____

**10.** The 32 pupils of a sixth grade wish to share equally the expense of a class trip costing $26.88. How much should each pupil pay? ________

| | |
|---|---|
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |
| 7 | 8 |
| 9 | 10 |

Number correct: ______. Date: ________________ ____, ________.
Write your score on the Problem Test record on page 160. Fill in the second bar on the graph form for Problem Tests on page 160.

# Review

**1.**

$$\begin{array}{rrr} 736 & \$40.95 & \$36.45 \\ 957 & 27.50 & .97 \\ 438 & 50.07 & 15.86 \\ 989 & 60.00 & 7.50 \\ +325 & +49.79 & +36.85 \\ \hline \end{array}$$

**2.**

$$\begin{array}{rrr} 302 & \$17.50 & \$120.10 \\ -176 & -9.87 & -79.85 \\ \hline \end{array}$$

**3.**

$$\begin{array}{rrr} 56 & \$9.10 & 325 \\ \times 95 & \times 80 & \times 672 \\ \hline \end{array}$$

**4.**

$$\begin{array}{rrr} \frac{2}{3} & \frac{1}{2} & 2\frac{1}{2} \\ +\frac{3}{4} & -\frac{3}{8} & +3\frac{5}{6} \\ \hline \end{array}$$

**5.** Name as decimals.

$2\frac{2}{10}$ ______ $6\frac{5}{100}$ ______ $4\frac{17}{1,000}$ ______

**6.** Name as mixed forms.

4.700 ______ 7.15 ______ 6.405 ______

**7.** $7\overline{)224}$ $8\overline{)675}$ $32\overline{)\$16.96}$

# Progress Test 2

In Ex. 1 and 2, name an equivalent fraction in lowest terms.

**1.** $\frac{24}{36} =$ **2.** $\frac{45}{81} =$

**3.**, **4.**, **5.**

$$\begin{array}{rrr} 3\frac{1}{4} & \frac{7}{10} & 8 \\ +7\frac{2}{3} & -\frac{1}{2} & -2\frac{5}{8} \\ \hline \end{array}$$

**6.** Show the solution set for this sentence if $n$ stands for any whole number.

$$n \times 9 \leq 45$$

**7.** Name, using digits and a decimal point: nine and fifty-five thousandths. ______

**8.** What part of a yard is 24 inches? ______

**9.** At $1.20 a pound, you get ______ pound of steak for $.90.

**10.** Find the average of 66, 58, 75, and 97. ______

**8**

**9**

**10**

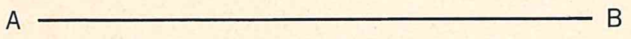
Number correct: ______. Date: ____________ ______, ______.
Write your score on the Progress Test Record on page 160. Fill in the second bar in the Progress Test graph form on page 160.

# Measuring line segments

Measure the line segments below *to the nearest* inch, half inch, quarter inch, and eighth inch.

WORK SPACE

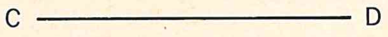
**1.**



**a** inch ____ **b** half inch ____

**c** quarter inch ____ **d** eighth inch ____

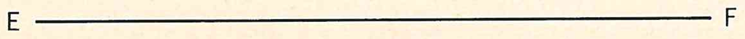
**2.**



**a** inch ____ **b** half inch ____

**c** quarter inch ____ **d** eighth inch ____

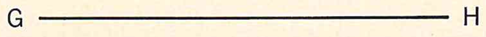
**3.**



**a** inch ____ **b** half inch ____

**c** quarter inch ____ **d** eighth inch ____

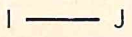
**4.**



**a** inch ____ **b** half inch ____

**c** quarter inch ____ **d** eighth inch ____

**5.**



**a** inch ____ **b** half inch ____

**c** quarter inch ____ **d** eighth inch ____

**6.** Find the sum of your answers in Ex. 1 to 5 for:

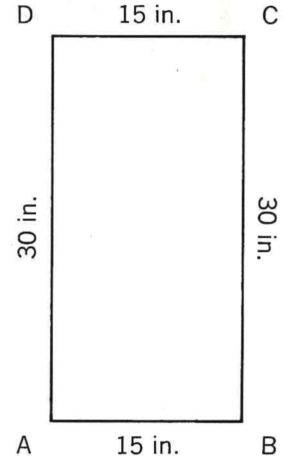
part **a** ____ part **b** ____ part **c** ____ part **d** ____

**7.** Why didn't you get the same number for parts **a**, **b**, **c**, and **d**?

____

# Perimeter of rectangles and squares

The sum of the lengths of the sides of a polygon is called the **perimeter** of the polygon.



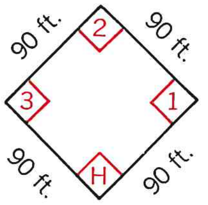
**1.** The perimeter of rectangle $ABCD$ at the right is:

____ + ____ + ____ + ____, or ____ inches.

**2.** Other ways to find the perimeter of rectangle $ABCD$ are:

- 2 × (30 + 15), or ____ inches.
- (2 × 30) + (2 × 15), or ____ inches.

**3.** A baseball diamond is really a square. The distance from each base to the next is 90 feet. If you hit a home run, how many feet would you have to run?



- ____ + ____ + ____ + ____, or ____ feet.
- (4 × ____), or ____ feet.

WORK SPACE

**4.** Mr. Allen wants to make a yard for his dog. How much fencing will he need if he makes a rectangular yard 20 feet long and 4 yards wide? (First express the 4 yards as feet.)

____

**5.** How much fencing will Mr. Allen need if he makes the yard square with 18 feet on a side? ____

**6.** What is the perimeter of a rectangle that is 20 yards long and 50 feet wide? ____

**7.** What is the perimeter of a rectangle $1\frac{1}{2}$ feet wide and 7 yards long? ____

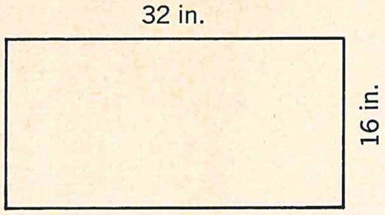
**8.** What is the perimeter of a rectangular flower bed 12 feet long and 96 inches wide? ____

# Finding the perimeter

— Name each polygon below and then find its perimeter.

WORK SPACE

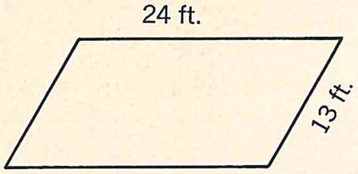
**1.**



Name ____________

Perimeter ____________

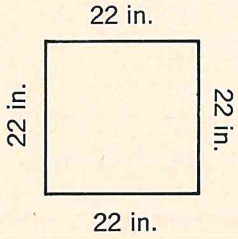
**2.**



Name ____________

Perimeter ____________

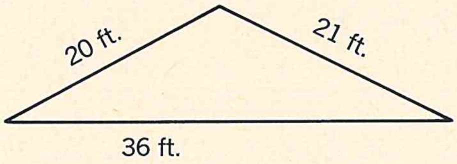
**3.**



Name ____________

Perimeter ____________

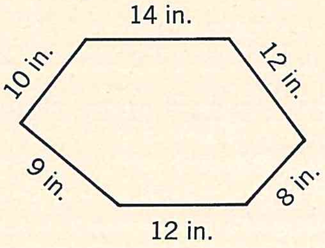
**4.**



Name ____________

Perimeter ____________

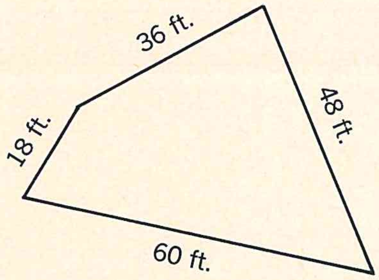
**5.**



Name ____________

Perimeter ____________

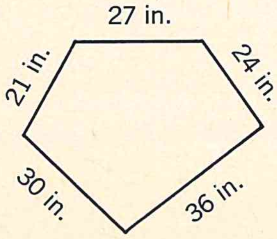
**6.**



Name ____________

Perimeter ____________

**7.**

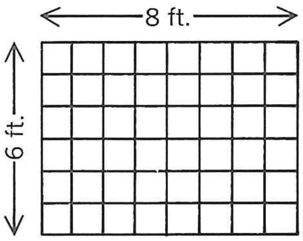


Name ____________

Perimeter ____________

# Area of rectangular regions

**1.** Ann has marked off a plot of ground 8 feet long and 6 feet wide for a vegetable garden. To find how many *square feet* there are in the plot, she made this drawing.

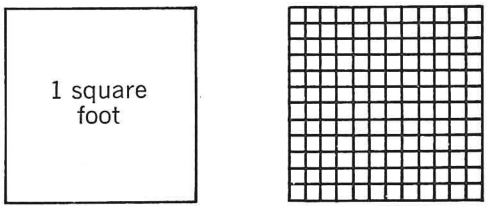


There are 8 square feet in the top row, and there are 6 rows of 8 square feet each. The **area** is 6 × 8, or _____ square feet.

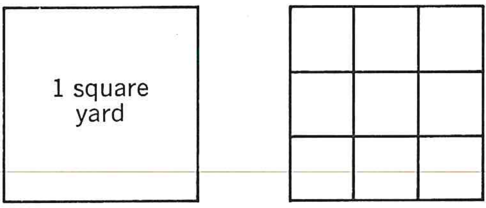
— Find the areas of rectangular regions having these dimensions.

| | LENGTH | WIDTH | AREA |
|---|---|---|---|
| **2.** | 12 ft. | 8 ft. | _____ sq. ft. |
| **3.** | 15 ft. | 9 ft. | _____ sq. ft. |
| **4.** | 24 in. | 14 in. | _____ sq. in. |
| **5.** | 36 yd. | 18 yd. | _____ sq. yd. |
| **6.** | 44 ft. | 19 ft. | _____ sq. ft. |
| **7.** | 90 in. | 90 in. | _____ sq. in. |
| **8.** | 123 yd. | 84 yd. | _____ sq. yd. |

— Look at these related units of area.



1 square foot makes 144 square inches



1 square yard makes 9 square feet

— Solve these sentences.

**9.** 16 sq. yd. make _____ sq. ft.

**10.** 153 sq. ft. make _____ sq. yd.

**11.** 20 sq. ft. make _____ sq. in.

**12.** 2 sq. yd. make _____ sq. in.

— Find the area of these rectangular regions in the unit indicated.

**13.** 81 ft. by 45 ft. _______ sq. yd.

**14.** 15 yd. by 9 yd. _______ sq. ft.

**15.** 12 ft. by 8 ft. _______ sq. in.

WORK SPACE

## Area and perimeter

— Find the perimeter and area of the rectangular regions with the dimensions given below.

| | LENGTH | WIDTH | PERIMETER | AREA | WORK SPACE |
|---|---|---|---|---|---|
| **1.** | 12 in. | 8 in. | ______ in. | ______ sq. in. | |
| **2.** | 14 ft. | 18 ft. | ______ ft. | ______ sq. ft. | |
| **3.** | 2 yd. | 5 ft. | ______ ft. | ______ sq. ft. | |
| **4.** | 2 ft. | 9 in. | ______ in. | ______ sq. in. | |
| **5.** | 1 yd. | 20 in. | ______ in. | ______ sq. in. | |
| **6.** | 4 yd. | 7 ft. | ______ ft. | ______ sq. ft. | |
| **7.** | 5 in. | 4 ft. | ______ in. | ______ sq. in. | |
| **8.** | 12 ft. | 6 ft. | ______ yd. | ______ sq. yd. | |
| **9.** | 24 in. | 48 in. | ______ ft. | ______ sq. ft. | |
| **10.** | 6 ft. | 4 ft. | ______ in. | ______ sq. in. | |
| **11.** | 8 yd. | 5 yd. | ______ ft. | ______ sq. ft. | |
| **12.** | 7 in. | 2 yd. | ______ in. | ______ sq. in. | |
| **13.** | 9 in. | 4 ft. | ______ in. | ______ sq. in. | |
| **14.** | 18 in. | 30 in. | ______ ft. | ______ sq. ft. | |
| **15.** | 6 yd. | 18 yd. | ______ ft. | ______ sq. ft. | |
| **16.** | 30 ft. | 6 yd. | ______ yd. | ______ sq. yd. | |

# Problem solving

Figure A below represents an empty lot which is 90 feet long and 50 feet wide.

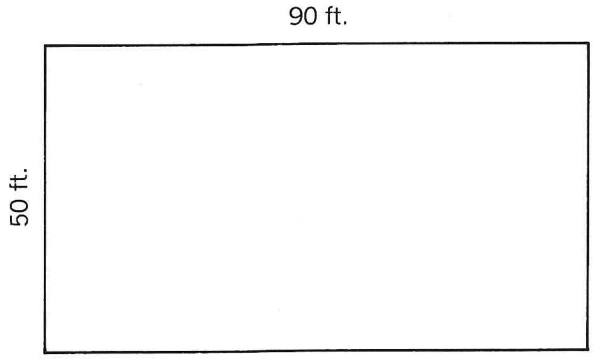


*Figure A*

— Solve the problems in Ex. 1 to 5.

**1.** What is the perimeter of the lot in feet? ________ in yards? ________

**2.** What is the area in square feet? ________ in square yards? ________

**3.** How much would it cost to enclose the lot if fencing costs $3.50 a foot? ________

**4.** If a pound of grass seed covers 75 square feet of ground, how many pounds would be needed to cover the lot? ________

**5.** If grass seed costs $2.10 a pound, it would cost ________ to seed the lot.

Figures B and C represent an aerial view of Central School and its property.

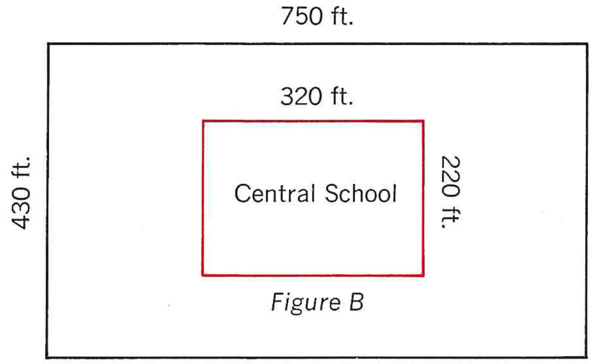


*Figure C*

— Solve the problems in Ex. 6 to 10.

**6.** What is the perimeter of the ground on which the school is built (*Figure B*)? ________

**7.** What is the perimeter of the school property (*Figure C*) ________

**8.** What is the area of the ground on which the school is built? ________

**9.** What is the area of the entire school property? ________

**10.** How much will it cost to enclose the school property if fencing costs $3.00 a foot? ________

WORK SPACE

## Adding measures

**1.** In the example at the right the first answer, 4 ft. 13 in., is renamed as 5 ft. 1 in. since 13 inches make ___ foot ___ inch. You can say that 5 feet 1 inch is the simplest form for naming the sum of 2 feet 5 inches and 2 feet 8 inches.

$$\begin{array}{r} \text{2 ft. 5 in.} \\ +\text{ 2 ft. 8 in.} \\ \hline \text{4 ft. 13 in., or 5 ft. 1 in.} \end{array}$$

— Express the answers to the following in simplest form.

| | a | b |
|---|---|---|
| **2.** | 5 ft. 8 in.<br>+ 2 ft. 6 in. | 7 lb. 12 oz.<br>+ 4 lb. 8 oz. |
| **3.** | 2 da. 14 hr.<br>+ 2 da. 16 hr. | 9 hr. 40 min.<br>+ 4 hr. 35 min. |
| **4.** | 2 yr. 8 mo.<br>+ 1 yr. 10 mo. | 12 min. 34 sec.<br>+ 9 min. 52 sec. |
| **5.** | 4 yd. 2 ft.<br>+ 8 ft. | 1 gal. 3 qt.<br>+ 3 gal. 2 qt. |
| **6.** | 2 wk. 5 da.<br>+ 5 da. | 1 qt. 1 pt.<br>+ 3 qt. 1 pt. |
| **7.** | 4 lb. 10 oz.<br>+ 2 lb. 6 oz. | 2 da. 15 hr.<br>+ 1 da. 12 hr. |
| **8.** | 1 yd. 2 ft. 8 in.<br>+ 2 yd. 2 ft. 8 in. | 2 hr. 40 min. 50 sec.<br>+ 3 hr. 30 min. 20 sec. |

# Subtracting measures

**1.** To subtract 1 year 11 months from 3 years 9 months, as shown in the example at the right, you know that you must rename 3 years 9 months as _____ years _____ months. What is the answer?

__________

$\overset{2}{\cancel{3}}$ yr. $\overset{21}{\cancel{9}}$ mo.
– 1 yr. 11 mo.
1 yr. 10 mo.

— Find the answers to the following examples.

| | a | b | c |
|---|---|---|---|
| **2.** | 8 lb. 4 oz.<br>– 5 lb. 6 oz. | 4 da. 6 hr.<br>– 1 da. 10 hr. | 3 gal. 1 qt.<br>– 1 gal. 2 qt. |
| **3.** | 6 hr. 18 min.<br>– 2 hr. 37 min. | 5 ft. 5 in.<br>– 3 ft. 7 in. | 4 da. 8 hr.<br>– 2 da. 15 hr. |
| **4.** | 4 yd. 1 ft.<br>– 1 yd. 2 ft. | 7 qt.<br>– 3 qt. 1 pt. | 12 lb. 8 oz.<br>– 4 lb. 10 oz. |
| **5.** | 14 yr. 5 mo.<br>– 7 yr. 10 mo. | 9 yd. 1 ft.<br>– 3 yd. 2 ft. | 8 ft.<br>– 7 ft. 8 in. |
| **6.** | 11 yd.<br>– 2 yd. 1 ft. | 30 min. 10 sec.<br>– 1 min. 45 sec. | 5 wk.<br>– 2 wk. 5 da. |
| **7.** | 5 wk. 3 da.<br>– 5 da. 10 hr. | 2 hr. 10 min. 5 sec.<br>– 20 min. 15 sec. | 2 yd. 1 ft. 3 in.<br>– 2 ft. 6 in. |
| **8.** | 5 hr. 2 min. 15 sec.<br>– 5 min. 30 sec. | 3 gal. 1 qt.<br>– 3 qt. 1 pt. | 5 da. 10 hr. 20 min.<br>– 2 da. 18 hr. 30 min. |

# Distance, rate, and time

**A** Distance = Time × Rate

**1.** At the rate of 80 miles an hour, a train will travel _____ miles in 5 hours.

**B** Rate = Distance ÷ Time

**2.** A bus traveled 240 miles in 6 hours. The average rate was _____ miles an hour.

**C** Time = Distance ÷ Rate

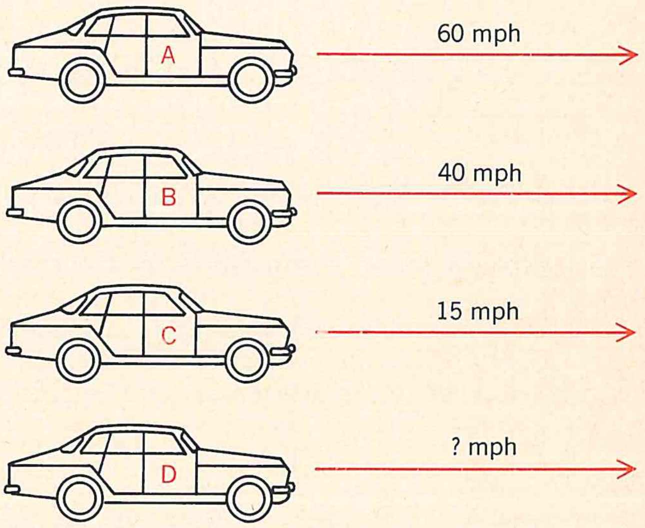
**3.** If a Hiking Club averages 3 miles an hour on a 12-mile hike, the hike should take about _____ hours.

**4.** If each car traveled for 7 hours, then:

car **A** would go _______ miles.

car **B** would go _______ miles.

car **C** would go _______ miles.



**5.** How many hours would it take cars **A**, **B**, and **C** to travel 300 miles?

**A** _____ **B** _____ **C** _____

**6.** What would car **D**'s speed be if it traveled 175 miles in 5 hours? ________ 312 miles in 6 hours? ________

**7.** If car **A** traveled for 3 hours and stopped, how many hours would cars **B** and **C** have to travel to catch up to it?

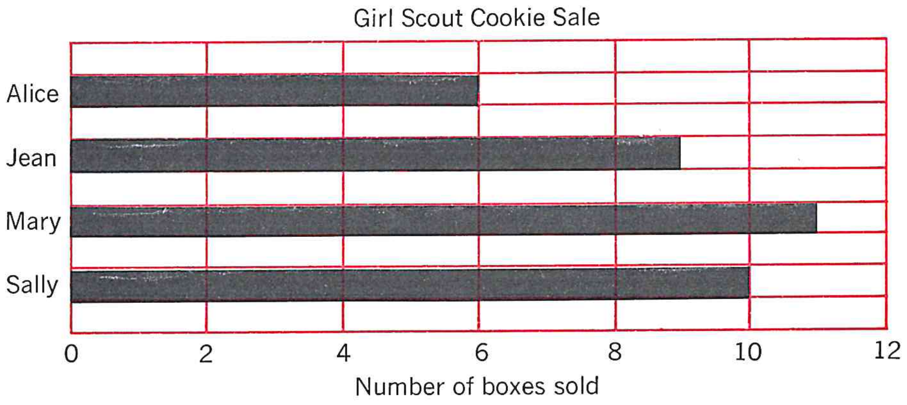
**B** _____ **C** _____

**8.** Car **A** travels how many miles per hour? _____ how many miles per minute? _____ how many feet per second? _____

WORK SPACE

# Bar graphs

Here is a **bar graph** that shows how many boxes of cookies were sold by four Girl Scouts.



WORK SPACE

**1.** How many boxes of Girl Scout cookies did each girl sell?

Alice _____ Jean _____ Mary _____ Sally _____

**2.** How many boxes did the four girls sell all together? _____

**3.** How many more boxes did Mary sell than Jean? _____

**4.** How many more boxes did Sally sell than Alice? _____

**5.** Alice's sales were what part of the total sales of the four girls?

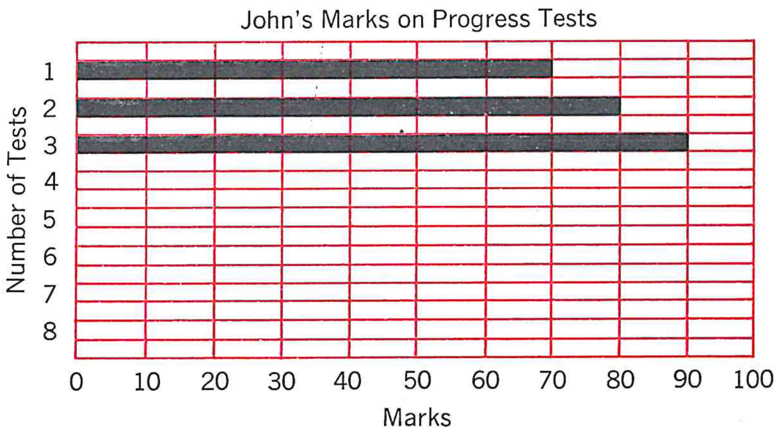
_____

**6.** Jean sold _____ times as many boxes as Alice.

**7.** If each box sold for $1.20, what was the total amount collected by the four girls? _____

**8.** If the troop kept $.50 from each box sold, what was the total amount the four girls earned for the troop? _____

**9.** Complete John's graph to show that his mark on Test 4 was 80; Test 5 was 70; Test 6 was 70; Test 7 was 90; and Test 8 was 100.

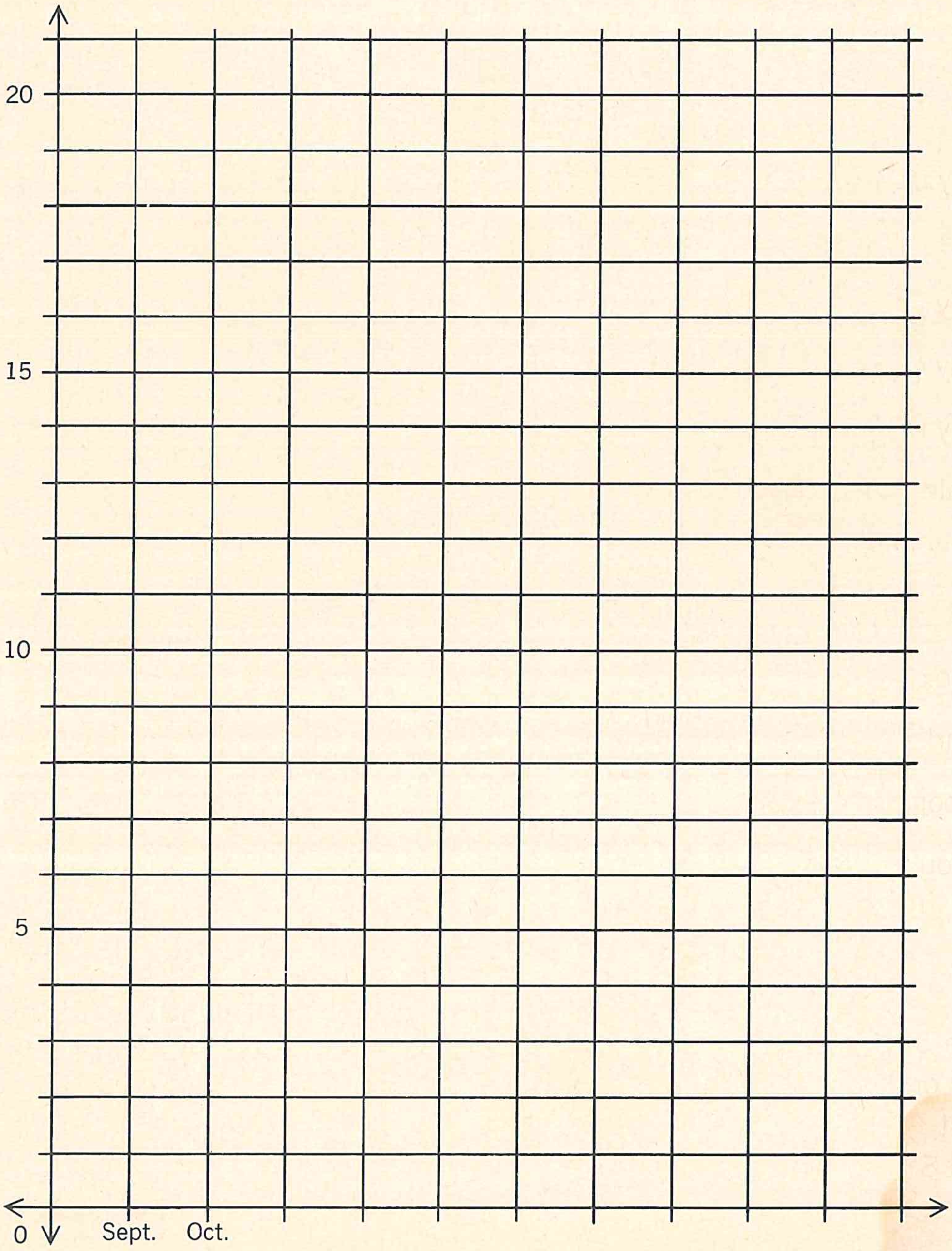


# Line graphs

— Complete the line graph below to show the following total absences in Miss Green's sixth-grade class last year.

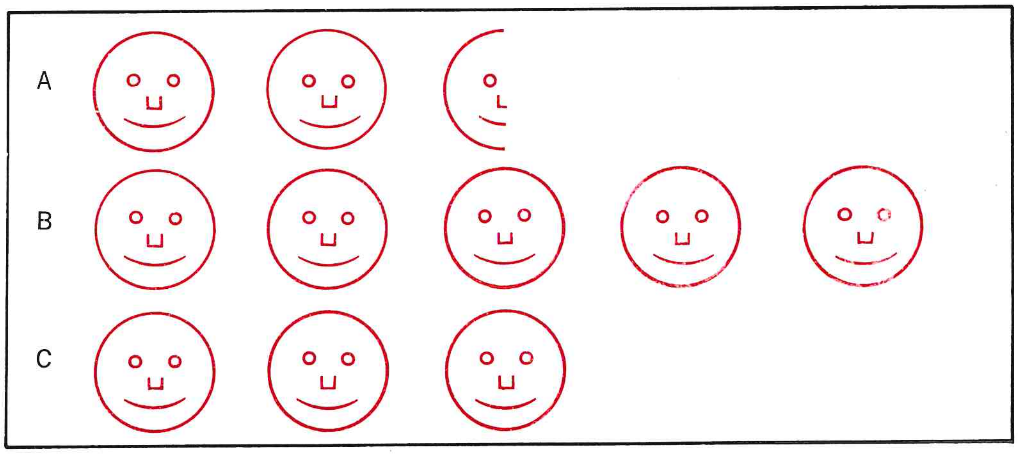
Sept. — 16
Oct. — 12
Nov. — 14
Dec. — 20
Jan. — 18
Feb. — 15
Mar. — 17
Apr. — 8
May — 10
June — 8

— First locate the points on the graph showing the absences for each month. Then join the points together with line segments. Be sure to include a title and any necessary labels.



# Pictographs

Mathematics Test Grades



Each ☺ represents two pupils.

**1.** How many pupils had test grades of **A**? _____ **B**? _____ **C**? _____

**2.** How many pupils had below **C** as their grade ? _____

**3.** How many pupils took the test? _____

**4.** How many more pupils had **B** than **A** as their grade? _____

**5.** How many more pupils had **C** than **A** as their grade? _____

**6.** What part of the class had **A** as their grade? _____

**7.** Decide what things you should consider when choosing a symbol for a pictograph. Then make a pictograph below to show something about your class.

# Review

— Write the decimal numeral that names the same number as:

**1.** $34_{five}$ _____ **2.** $230_{four}$ _____ **3.** XVII _____ **4.** MCIV _____

— Round 5,463 to the nearest:

**5.** thousand _____ **6.** hundred _____ **7.** ten _____ **8.** ten thousand _____

WORK SPACE

— Find the average of:

**9.** 12, 16, 17, 51 _____ **10.** 47, 85, 90 _____

— Name the missing numerator or denominator.

**11.** $\frac{2}{3} = \frac{\quad}{18}$ $\frac{5}{8} = \frac{\quad}{56}$ $\frac{7}{10} = \frac{21}{\quad}$ $\frac{4}{11} = \frac{\quad}{99}$

**12.** $\frac{18}{20} = \frac{9}{\quad}$ $\frac{24}{36} = \frac{\quad}{12}$ $\frac{50}{75} = \frac{10}{\quad}$ $\frac{16}{80} = \frac{1}{\quad}$

— Name the number that will make each sentence true.

**13.** $n + 12 = 40$ $n =$ _____ $n - 8 = 15$ $n =$ _____

**14.** $n + n = 18$ $n =$ _____ $42 - n = 14$ $n =$ _____

**15.** $48 \div n = 2$ $n =$ _____ $n \div 3 = 7$ $n =$ _____

**16.** $9 \times n = 72$ $n =$ _____ $17 \times 12 = n$ $n =$ _____

**17.** If A = {0, 2, 4, 6} and B = {4, 5, 6, 7, 8} then:

$A \cap B = \{\_\_\_\_\_\_\}$ $A \cup B = \{\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\}$

— Place the decimal point so that each statement is sensible.

**18.** Tom grew an ear of sweet corn 1 2 4 5 inches long.

**19.** A sixth-grade boy is 6 8 2 inches tall.

**20.** George weighs 9 5 5 pounds.

**21.** Dave was paid $1 5 0 for working two hours.

**22.** Mr. Betts drove 1 6 5 4 miles in 3 hours.

**23.** In one hour 1 6 7 inches of rain fell.

**24.** Ann paid $1 4 9 for a pen.

**25.** Jane's workbook is 1 0 5 inches long and 8 2 5 inches wide.

# Estimating quotients named by three-digit numerals

**1.** If you want to divide 32,508 by 63, first estimate the quotient. Think:

- 32,508 is about 32 thousands
- 63 is about 6 tens
- 32 thousands ÷ 6 tens is about 5 hundreds.
- 500 × 63 = ______
- the quotient will be _____-some.

In the box at the right, show the estimated quotient, solve the example and check it.

63)32,508 Estimate ______
Check

**2.** Estimate the quotient for 12,000 divided by 25. Think:

- 25 is between 2 tens and 3 tens
- 12 thousands ÷ 2 tens is 6 hundreds
- 12 thousands ÷ 3 tens is 4 hundreds
- the quotient is greater than 400, but less than 600. It might be 400-some, 500-some or 600-some.

400 × 25 = _____ 500 × 25 = _____ 600 × 25 = _____

- the quotient will be _____-some.

In the box at the right, show the estimated quotient, solve the example and check it.

25)12,000 Estimate ______
Check

— First estimate the quotient, then compute and check your answers.

| | a | b | c |
|---|---|---|---|
| **3.** | 38)12,388 Estimate ______<br>Check | 61)14,274 Estimate ______<br>Check | 47)43,569 Estimate ______<br>Check |
| **4.** | 78)18,018 Estimate ______<br>Check | 87)64,032 Estimate ______<br>Check | 94)39,950 Estimate ______<br>Check |

# Quotients named by three-digit numerals

— Compute your answers and check on a separate sheet of paper.

|  | a | b | c | d |
|---|---|---|---|---|
| **1.** | $48\overline{)13,248}$ | $63\overline{)20,664}$ | $71\overline{)39,902}$ | $39\overline{)16,926}$ |
| **2.** | $23\overline{)15,594}$ | $54\overline{)23,166}$ | $87\overline{)15,486}$ | $95\overline{)77,235}$ |
| **3.** | $33\overline{)12,177}$ | $78\overline{)36,114}$ | $29\overline{)20,938}$ | $37\overline{)20,054}$ |
| **4.** | $43\overline{)12,599}$ | $61\overline{)11,956}$ | $58\overline{)19,778}$ | $76\overline{)69,616}$ |
| **5.** | $32\overline{)26,368}$ | $25\overline{)18,375}$ | $98\overline{)28,126}$ | $84\overline{)44,268}$ |

# Zero in the quotient

— Study the examples that are done for you. Then compute your answers and check on a separate sheet of paper.

| | a | b | c | d |
|---|---|---|---|---|
| **1.** | $\begin{array}{r} 607 \\ 35\overline{)21{,}245} \\ \underline{21\ 000} \\ 245 \\ \underline{245} \\ 0 \end{array}$ | $58\overline{)12{,}122}$ | $47\overline{)23{,}829}$ | $82\overline{)66{,}256}$ |
| **2.** | $73\overline{)51{,}173}$ | $29\overline{)11{,}774}$ | $76\overline{)23{,}180}$ | $94\overline{)9{,}588}$ |
| **3.** | $67\overline{)60{,}501}$ | $34\overline{)24{,}106}$ | $79\overline{)8{,}532}$ | $52\overline{)21{,}060}$ |
| **4.** | $\begin{array}{r} 770 \\ 45\overline{)34{,}650} \\ \underline{31\ 500} \\ 3\ 150 \\ \underline{3\ 150} \\ 0 \end{array}$ | $52\overline{)18{,}200}$ | $54\overline{)12{,}420}$ | $62\overline{)20{,}460}$ |
| **5.** | $47\overline{)37{,}130}$ | $83\overline{)25{,}730}$ | $94\overline{)30{,}080}$ | $69\overline{)27{,}600}$ |

# Division with nonzero remainders

— Compute your answers and check on a separate sheet of paper. The first one is done for you.

| | a | b | c | d |
|---|---|---|---|---|
| **1.** | 324 r3<br>32)10,371<br>9 600<br>771<br>640<br>131<br>128<br>3 | 25)10,407 | 58)36,835 | 72)67,105 |
| **2.** | 43)22,410 | 61)15,986 | 84)10,341 | 26)18,489 |
| **3.** | 35)15,549 | 47)14,807 | 64)34,757 | 73)45,118 |
| **4.** | 55)50,163 | 82)59,953 | 36)5,371 | 28)6,169 |
| **5.** | 41)22,678 | 93)29,863 | 19)8,894 | 38)27,059 |

# Division with money

— Compute your answers and check on a separate sheet of paper. The first one is done for you.

| a | b | c | d |
|---|---|---|---|
| 1.<br>$ 8.16<br>23)$187.68<br>184 00<br>3 68<br>2 30<br>1 38<br>1 38<br>0 | 42)$179.76 | 71)$408.96 | 85)$260.95 |
| 2.<br>56)$214.48 | 68)$170.68 | 33)$245.85 | 62)$499.72 |
| 3.<br>28)$178.92 | 45)$231.75 | 16)$147.36 | 49)$295.47 |
| 4.<br>26)$182.78 | 39)$189.93 | 28)$74.48 | 73)$259.88 |
| 5.<br>49)$199.92 | 51)$461.55 | 72)$149.04 | 93)$473.37 |

# Divisors named by three-digit numerals

— Compute your answers and check on a separate sheet of paper. The first one is done for you.

| | a | b | c | d |
|---|---|---|---|---|
| 1. | 412<br>356)146,672<br>142 400<br>4 272<br>3 560<br>712<br>712<br>0 | 426)264,972 | 562)226,486 | 231)$140.91 |
| 2. | 397)358,491 | 535)246,635 | 627)239,514 | 163)$881.83 |
| 3. | 517)434,280 | 708)131,688 | 912)220,704 | 154)$274.12 |
| 4. | 479)113,592 | 395)375,645 | 805)589,650 | 438)$205.86 |
| 5. | 512)145,408 | 628)471,000 | 873)268,011 | 843)$581.67 |

# Problem solving

1. The Ryans went on a cross-country trip last summer. If they traveled 8,832 miles in 23 days, how many miles did they average per day? _____

2. If Mr. Ryan's car averaged 16 miles to a gallon of gasoline, about how many gallons did he use on the 23-day trip?

_____

3. If the Ryans' food and lodging cost $661.25 for the trip, what was the average cost per day? _______

4. During a magazine sale the 18 classes in Cedar School sold 1,836 subscriptions. How many subscriptions did each class average? _____

5. During last month the Grant School had a total attendance of 7,752 in 19 school days. How many students per day was the average attendance? _____

6. Last year it cost Mr. Barry $907.20 to build an extra room on his house. What was the average cost per month?

_______

7. If the Gordon High School basketball team scored 1,728 points in 24 games, how many points did they average per game? _____

8. The 345 pupils in the Hamilton School deposited $258.75 in the School Savings Bank. What was the average deposit per pupil? _____

| | |
|---|---|
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |
| 7 | 8 |

# Multiplying measures

Jerry has football practice 1 hour and 15 minutes each day, five days a week. How many hours does he practice in a week?

The example at the right shows that he practices 5 hours and 75 minutes in a week, or 6 hours and 15 minutes.

1 hr. 15 min.
× 5
5 hr. 75 min., or
6 hr. 15 min.

— Name the products in simplest form.

| | a | b | c |
|---|---|---|---|
| 1. | 2 qt. 1 pt.<br>× 3 | 3 yd. 2 ft.<br>× 4 | 1 wk. 5 da.<br>× 2 |
| 2. | 8 lb. 10 oz.<br>× 5 | 2 da. 14 hr.<br>× 2 | 5 hr. 28 min.<br>× 3 |
| 3. | 4 yr. 7 mo.<br>× 4 | 3 min. 32 sec.<br>× 5 | 2 yd. 9 in.<br>× 6 |
| 4. | 3 wk. 4 da.<br>× 3 | 5 gal. 3 qt.<br>× 6 | 4 yd. 1 ft.<br>× 7 |
| 5. | 3 qt. 1 pt.<br>× 9 | 2 hr. 40 min.<br>× 5 | 5 da. 8 hr.<br>× 4 |
| 6. | 12 lb. 9 oz.<br>× 4 | 6 yr. 11 mo.<br>× 3 | 8 yr. 9 mo.<br>× 5 |

| | a | b |
|---|---|---|
| 7. | 2 yd. 2 ft. 9 in.<br>× 3 | 1 hr. 51 min. 42 sec.<br>× 6 |

# Dividing measures

The examples at the right show two ways to divide 4 gallons 2 quarts by 3.

- In example A, the 4 gallons 2 quarts are renamed as 3 gallons 6 quarts and then divided by 3, showing a quotient of 1 gallon 2 quarts.
- In example B, the 4 gallons 2 quarts are renamed as 18 quarts and then divided by 3, showing a quotient of 6 quarts, or 1 gallon 2 quarts.

?
3)4 gal. 2 qt.

**A**
1 gal. 2 qt.
3)3 gal. 6 qt.

**B**
6 qt., or 1 gal. 2 qt.
3)18 qt.

— Name the quotients in simplest form.

| | a | b | c |
|---|---|---|---|
| **1.** | 5)8 hr. 20 min. | 3)2 da. 6 hr. | 2)3 wk. 5 da. |
| **2.** | 3)5 gal. 1 qt. | 5)11 yd. 2 ft. | 7)5 ft. 3 in. |
| **3.** | 6)8 lb. 4 oz. | 6)20 hr. 30 min. | 7)1 lb. 5 oz. |
| **4.** | 4)6 yd. 2 ft. | 3)5 wk. 4 da. | 2)9 gal. 2 qt. |
| **5.** | 3)19 qt. 1 pt. | 7)25 min. 5 sec. | 8)9 yr. 4 mo. |
| **6.** | 4)6 yd. 2 ft. 8 in. | 7)10 gal. 5 qt. 1 pt. | 4)13 wk. 3 da. 4 hr. |
| **7.** | 3)10 yd. 2 ft. 6 in. | 2)3 da. 6 hr. 40 min. | 5)14 gal. 1 qt. 1 pt. |

## Problem Test 3

**1.** Mary's mother bought articles costing $1.07, $2.89, $.89, and $3.95. How much change should she receive from a ten-dollar bill? ______

**2.** If a regulation bowling ball weighs 16 pounds, what would be the total weight of 36 bowling balls? ________

**3.** The Silver Chief travels 1,159 miles in 19 hours. What is its average rate of speed per hour? ________

**4.** A car was driven 405 miles at an average speed of 45 miles per hour. How long did the trip take? ________

**5.** A professional football field is 300 feet from goal post to goal post and 160 feet wide. What is its perimeter? ________

**6.** How many 1-foot square tiles would be needed to tile the floor of a storage room 23 feet by 6 yards? _____

**7.** Flying at an average speed of 580 miles per hour, what distance will a plane travel in 6 hours? ________

**8.** Mrs. Kane bought a $4\frac{3}{4}$-pound chicken and a $5\frac{1}{2}$-pound chicken. She bought _____ pounds of chicken in all.

**9.** Dora's baby brother weighed 6 pounds 14 ounces at birth. Now he weighs 19 pounds 3 ounces. He has gained _____ pounds _____ ounces since birth.

**10.** Peter spends 4 hours and 30 minutes a day in school, five days a week. How much time does he spend in school in a week?

__________

Number correct: _____. Date: ____________ ___, _______.
Write your score in the Problem Test Record on page 160. Fill in the third bar on the graph form for Problem Tests, page 160.

| | |
|---|---|
| 1 | 2 |
| 3 | |
| 4 | |
| 5 | 6 |
| 7 | 8 |
| 9 | |
| 10 | |

# Review

**1.**
$$\begin{array}{r} 479\\ 825\\ 763\\ 485\\ 397\\ +768\\ \hline \end{array} \qquad \begin{array}{r} 709\\ 805\\ 780\\ 576\\ 408\\ +970\\ \hline \end{array} \qquad \begin{array}{r} \$12.32\\ 7.56\\ 23.50\\ .84\\ 54.92\\ +\ 9.05\\ \hline \end{array}$$

**2.**
$$\begin{array}{r} 752\\ -297\\ \hline \end{array} \qquad \begin{array}{r} 3,215\\ -1,786\\ \hline \end{array} \qquad \begin{array}{r} \$60.10\\ -37.95\\ \hline \end{array}$$

**3.**
$$\begin{array}{r} 356\\ \times 98\\ \hline \end{array} \qquad \begin{array}{r} 450\\ \times 309\\ \hline \end{array} \qquad \begin{array}{r} 794\\ \times 680\\ \hline \end{array}$$

**4.**
$$46\overline{)\$149.50} \qquad 64\overline{)18,757}$$

**5.**
$$\begin{array}{r} 2\frac{1}{2}\\ +3\frac{2}{3}\\ \hline \end{array} \qquad \begin{array}{r} 8\frac{1}{5}\\ -4\frac{1}{2}\\ \hline \end{array}$$

**6.**
$$\begin{array}{r} \text{2 ft. 7 in.}\\ +\text{4 ft. 8 in.}\\ \hline \end{array} \qquad \begin{array}{r} \text{5 lb. 3 oz.}\\ -\text{2 lb. 7 oz.}\\ \hline \end{array}$$

**7.**
$$\begin{array}{r} \text{5 min. 30 sec.}\\ \times 6\\ \hline \end{array}$$

**8.**
$$3\overline{)\text{7 ft. 6 in.}}$$

# Progress Test 3

**1.** $57\overline{)\$165.30}$

**2.** $46\overline{)29,854}$

**3.** $49\overline{)19,992}$

**4.** $432\overline{)24,192}$

**5.**
$$\begin{array}{r} \text{4 ft. 9 in.}\\ \times 9\\ \hline \end{array}$$

**6.** $4\overline{)\text{6 hr. 40 min.}}$

**7.** Find the average of 55, 49, 62, and 66. ______

**8.** How many square yards of linoleum are needed for a kitchen floor 24 feet by 6 yards? __________

**9.** What is the perimeter in yards of a parking lot 144 feet long and 60 yards wide?

__________

**10.** Driving at an average rate of 40 miles an hour, Mr. Jones can travel 360 miles in ______ hours.

| |
|---|
| 7 |
| 8 |
| 9 |
| 10 |

Number correct: ______. Date: ______________ ______, ________.
Write your score in the Progress Test Record on page 160. Fill in the third bar on the graph form for Progress Tests, page 160.

# Finding the product of two fractional numbers

To find the product of two fractional numbers, first find the product of the numerators; then find the product of the denominators.

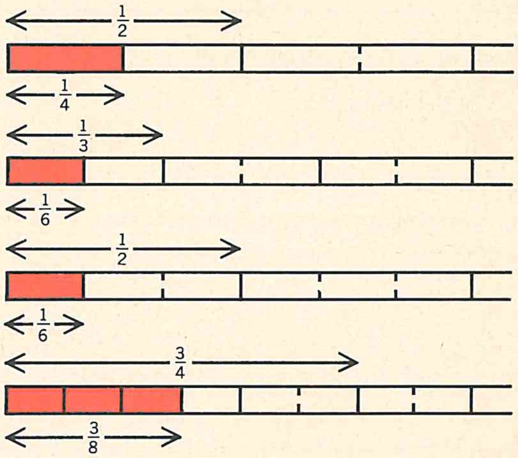
— Find the products in Ex. 1 to 4. The drawings at the right will help you.

**1.** $\frac{1}{2}$ of $\frac{1}{2} = \frac{1}{2} \times \frac{1}{2} = \frac{1 \times 1}{2 \times 2} =$ ______

**2.** $\frac{1}{2}$ of $\frac{1}{3} = \frac{1}{2} \times \frac{1}{3} = \frac{1 \times 1}{2 \times 3} =$ ______

**3.** $\frac{1}{3}$ of $\frac{1}{2} = \frac{1}{3} \times \frac{1}{2} = \frac{1 \times 1}{3 \times 2} =$ ______

**4.** $\frac{1}{2}$ of $\frac{3}{4} = \frac{1}{2} \times \frac{3}{4} = \frac{1 \times 3}{2 \times 4} =$ ______



— Name the products of the fractional numbers below in lowest terms: as an equivalent fraction, in mixed form, or as a numeral for a whole number.

| | a | b | c |
|---|---|---|---|
| **5.** | $\frac{2}{3} \times \frac{2}{9} =$ | $\frac{1}{4} \times \frac{3}{5} =$ | $\frac{5}{6} \times \frac{5}{6} =$ |
| **6.** | $\frac{7}{8} \times \frac{2}{3} =$ | $\frac{5}{6} \times \frac{8}{9} =$ | $\frac{10}{13} \times \frac{13}{10} =$ |
| **7.** | $\frac{4}{5} \times \frac{7}{8} =$ | $\frac{5}{8} \times \frac{2}{10} =$ | $\frac{4}{3} \times \frac{9}{4} =$ |
| **8.** | $\frac{5}{12} \times \frac{3}{2} =$ | $\frac{12}{3} \times \frac{2}{8} =$ | $\frac{2}{3} \times \frac{7}{3} =$ |
| **9.** | $\frac{8}{9} \times \frac{9}{8} =$ | $\frac{12}{5} \times \frac{3}{8} =$ | $\frac{14}{9} \times \frac{3}{7} =$ |
| **10.** | $\frac{5}{8} \times \frac{4}{5} =$ | $\frac{9}{10} \times \frac{10}{3} =$ | $\frac{2}{3} \times \frac{9}{16} =$ |

| | a | b |
|---|---|---|
| **11.** | $\frac{10}{7} \times \frac{3}{4} =$ | $\frac{9}{5} \times \frac{10}{11} =$ |
| **12.** | $\frac{4}{3} \times \frac{5}{2} =$ | $\frac{3}{2} \times \frac{8}{5} =$ |

# Multiplying a whole number by a fractional number

Shown below are two ways to find what number is $\frac{2}{3}$ of 18.

| A | B |
|---|---|
| $\frac{1}{3}$ of 18 is 6, so $\frac{2}{3}$ of 18 is $2 \times 6$, or 12 | $\frac{2}{3} \times 18 = \frac{2}{3} \times \frac{18}{1} = \frac{2 \times 18}{3 \times 1} = \frac{36}{3} = 12$ |

— Name the product of each number sentence below in lowest terms. Use either way shown above.

|  | a | b |
|---|---|---|
| **1.** | $\frac{2}{3} \times 24 =$ | $\frac{7}{8} \times 30 =$ |
| **2.** | $\frac{5}{6} \times 18 =$ | $\frac{4}{7} \times 28 =$ |
| **3.** | $\frac{7}{9} \times 4 =$ | $\frac{3}{10} \times 25 =$ |
| **4.** | $\frac{7}{8} \times 36 =$ | $\frac{1}{2} \times 11 =$ |
| **5.** | $\frac{2}{11} \times 30 =$ | $\frac{2}{3} \times 20 =$ |
| **6.** | $\frac{4}{15} \times 10 =$ | $\frac{5}{6} \times 40 =$ |
| **7.** | $\frac{2}{9} \times 12 =$ | $\frac{3}{20} \times 15 =$ |
| **8.** | $\frac{9}{10} \times 8 =$ | $\frac{7}{8} \times 15 =$ |
| **9.** | $\frac{4}{5} \times 35 =$ | $\frac{4}{7} \times 10 =$ |
| **10.** | $\frac{2}{3} \times 36 =$ | $\frac{5}{6} \times 22 =$ |

**11.** Joan uses $\frac{2}{3}$ of a ball of yarn to knit one mitten. How many balls must she buy to knit 3 pairs of mittens? _____

**12.** It takes Andy $\frac{3}{4}$ of an hour to mow the lawn at his home. Last year he mowed it 22 times. How many hours did he spend mowing the lawn? _____

| **11** | **12** |
|---|---|
|  |  |

# Practice

— Name as fractions.

| | a | b |
|---|---|---|
| **1.** | $1\frac{2}{5} =$ | $2\frac{1}{2} =$ |
| **2.** | $4\frac{3}{8} =$ | $3\frac{2}{3} =$ |
| **3.** | $2\frac{5}{6} =$ | $5\frac{1}{4} =$ |
| **4.** | $3\frac{2}{7} =$ | $4\frac{3}{10} =$ |
| **5.** | $6\frac{2}{5} =$ | $8\frac{3}{4} =$ |
| **6.** | $7\frac{5}{8} =$ | $5\frac{2}{9} =$ |
| **7.** | $6\frac{5}{7} =$ | $1\frac{9}{13} =$ |
| **8.** | $7\frac{9}{10} =$ | $4\frac{5}{6} =$ |
| **9.** | $2\frac{10}{11} =$ | $5\frac{5}{8} =$ |
| **10.** | $3\frac{7}{12} =$ | $9\frac{2}{3} =$ |

— Name as mixed forms.

| | a | b |
|---|---|---|
| **11.** | $\frac{12}{5} =$ | $\frac{20}{7} =$ |
| **12.** | $\frac{13}{8} =$ | $\frac{23}{7} =$ |
| **13.** | $\frac{17}{3} =$ | $\frac{24}{11} =$ |
| **14.** | $\frac{31}{9} =$ | $\frac{25}{7} =$ |
| **15.** | $\frac{21}{2} =$ | $\frac{29}{6} =$ |
| **16.** | $\frac{18}{11} =$ | $\frac{33}{10} =$ |
| **17.** | $\frac{32}{5} =$ | $\frac{23}{4} =$ |
| **18.** | $\frac{50}{9} =$ | $\frac{47}{8} =$ |
| **19.** | $\frac{39}{4} =$ | $\frac{60}{7} =$ |
| **20.** | $\frac{70}{3} =$ | $\frac{83}{5} =$ |

— Find the cost of each of the following.

**21.** $\frac{3}{4}$ dozen oranges at 60¢ a dozen. ______

**22.** $\frac{3}{4}$ pound of cookies at $1.20 a pound. ______

**23.** 27 inches of ribbon at 44¢ a yard. ______

**24.** 8 magnetic hooks at 54¢ a dozen. ______

**21**

**22**

**23**

**24**

# Multiplying whole numbers and mixed forms

The number sentence in the box shows how to multiply a whole number and a number in mixed form.

The number $3\frac{1}{2}$ is named as the fraction $\frac{7}{2}$, and the number 10 is named as the fraction $\frac{10}{1}$. Then the two fractional numbers are multiplied in the usual way.

$$3\tfrac{1}{2} \times 10 = \frac{7}{2} \times \frac{10}{1} = \frac{70}{2} = 35$$

— Solve each number sentence.

| | a | b |
|---|---|---|
| **1.** | $2\frac{1}{2} \times 12 =$ | $8 \times 3\frac{1}{3} =$ |
| **2.** | $18 \times 6\frac{2}{3} =$ | $4\frac{5}{6} \times 30 =$ |
| **3.** | $1\frac{2}{3} \times 15 =$ | $20 \times 2\frac{1}{5} =$ |
| **4.** | $16 \times 1\frac{1}{4} =$ | $6\frac{4}{7} \times 6 =$ |
| **5.** | $5\frac{2}{3} \times 12 =$ | $32 \times 4\frac{3}{10} =$ |
| **6.** | $9 \times 3\frac{3}{8} =$ | $2\frac{4}{9} \times 12 =$ |
| **7.** | $7\frac{3}{4} \times 14 =$ | $24 \times 3\frac{5}{12} =$ |
| **8.** | $40 \times 2\frac{5}{6} =$ | $7\frac{1}{2} \times 9 =$ |
| **9.** | $5\frac{2}{7} \times 6 =$ | $36 \times 1\frac{7}{9} =$ |
| **10.** | $18 \times 4\frac{2}{9} =$ | $6\frac{3}{5} \times 7 =$ |
| **11.** | $20\frac{1}{4} \times 8 =$ | $50 \times 2\frac{3}{4} =$ |

WORK SPACE

# A shortcut in computing

Study the multiplication sentences in boxes A, B, and C.

They show a shortcut you can use when you first divide by common factors before multiplying.

**A**

$$\frac{1}{2} \times \frac{2}{5} = \frac{1 \times \overset{1}{\cancel{2}}}{\underset{1}{\cancel{2}} \times 5} = \frac{1 \times 1}{1 \times 5} = \frac{1}{5}$$

**B**

$$\frac{2}{3} \times 12 = \frac{2 \times \overset{4}{\cancel{12}}}{\underset{1}{\cancel{3}} \times 1} = \frac{2 \times 4}{1 \times 1} = 8$$

**C**

$$\frac{\overset{1}{\cancel{3}}}{\underset{4}{\cancel{8}}} \times \frac{\overset{1}{\cancel{2}}}{\underset{3}{\cancel{9}}} = \frac{1}{12}$$

— Use the shortcut to solve each sentence. Name the products as a fraction in lowest terms or as a numeral for a whole number.

| | a | b | c |
|---|---|---|---|
| **1.** | $\frac{7}{8} \times \frac{4}{5} =$ | $\frac{3}{4} \times \frac{5}{6} =$ | $\frac{1}{7} \times \frac{7}{16} =$ |
| **2.** | $\frac{3}{7} \times \frac{5}{3} =$ | $\frac{5}{8} \times \frac{2}{5} =$ | $\frac{2}{3} \times 24 =$ |
| **3.** | $\frac{5}{12} \times \frac{2}{5} =$ | $\frac{9}{16} \times \frac{4}{9} =$ | $\frac{8}{10} \times \frac{10}{4} =$ |
| **4.** | $\frac{7}{8} \times \frac{16}{21} =$ | $\frac{8}{10} \times \frac{3}{9} =$ | $\frac{3}{8} \times 48 =$ |
| **5.** | $\frac{5}{9} \times \frac{18}{10} =$ | $\frac{3}{16} \times \frac{8}{9} =$ | $\frac{12}{5} \times \frac{3}{8} =$ |
| **6.** | $\frac{3}{4} \times 36 =$ | $\frac{5}{6} \times 30 =$ | $\frac{14}{3} \times \frac{6}{7} =$ |
| **7.** | $\frac{4}{9} \times \frac{6}{25} =$ | $\frac{5}{20} \times \frac{3}{7} =$ | $\frac{7}{9} \times 63 =$ |
| **8.** | $\frac{24}{7} \times \frac{14}{6} =$ | $\frac{14}{15} \times \frac{25}{28} =$ | $\frac{39}{4} \times \frac{4}{13} =$ |

# Using multiplication

**1.** To estimate the cost of $3\frac{1}{8}$ yards of canvas at $1.95 a yard, think:

- $3\frac{1}{8}$ yards is about 3 yards.
- $1.95 is about $2.00, so 3 yards will cost about ______.

**2.** Study examples A and B. What is the cost of the canvas? ______

In determining cost, fractions of a cent are rounded to the next higher cent.

**A**

$$3\frac{1}{8} \times 195 = \frac{25}{8} \times \frac{195}{1} = \frac{4,875}{8} = 609\frac{3}{8}$$

Cost: $6.10

**B**

$$\begin{array}{rr} & 195 \\ & \times\ 3\frac{1}{8} \\ \hline (\frac{1}{8} \times 195) \longrightarrow & 24\frac{3}{8} \\ (3 \times 195) \longrightarrow & 585 \\ \hline (3\frac{1}{8} \times 195) \longrightarrow & 609\frac{3}{8} \end{array}$$

Cost: $6.10

— First estimate, then find the products as shown in box B above.

| | a | b | c | d |
|---|---|---|---|---|
| **3.** | $\$.75 \times 2\frac{3}{4}$ | $\$1.25 \times 5\frac{2}{3}$ | $\$4.40 \times 6\frac{2}{3}$ | $\$5.25 \times 4\frac{5}{8}$ |
| **4.** | $\$3.74 \times 6\frac{5}{6}$ | $\$.89 \times 7\frac{3}{4}$ | $\$3.04 \times 4\frac{5}{6}$ | $\$2.53 \times 5\frac{3}{5}$ |
| **5.** | $\$2.95 \times 3\frac{3}{4}$ | $\$4.57 \times 5\frac{2}{3}$ | $\$8.09 \times 6\frac{3}{4}$ | $\$3.79 \times 4\frac{5}{8}$ |

**6.** Mary bought $2\frac{3}{4}$ yards of drip-dry cloth at $.95 a yard. She paid ________.

**7.** For his dog James bought $2\frac{3}{8}$ pounds of meat at 59¢ a pound. He paid ________.

| 6 | 7 |
|---|---|
| | |

# Factors named by fractions and mixed forms

**1.** Mary uses $2\frac{1}{2}$ cups of sugar to make fudge. If she makes only $\frac{1}{3}$ of the recipe, how much sugar should she use?

She needs to find $\frac{1}{3}$ of $2\frac{1}{2}$. Complete the multiplication shown at the right.

$\frac{1}{3} \times 2\frac{1}{2} = \frac{1}{3} \times \frac{5}{2} =$

Mary needs _____ cup of sugar.

— Name the products in lowest terms. Use a shortcut whenever possible.

| | a | b |
|---|---|---|
| **2.** | $\frac{1}{3} \times 3\frac{1}{2} = \frac{1}{3} \times \frac{7}{2} = \frac{7}{6} =$ | $\frac{2}{3} \times 3\frac{3}{8} =$ |
| **3.** | $\frac{1}{5} \times 7\frac{1}{2} = \frac{1}{\underset{1}{\cancel{5}}} \times \frac{\overset{3}{\cancel{15}}}{2} = \frac{3}{2} =$ | $\frac{9}{10} \times 3\frac{1}{3} =$ |
| **4.** | $\frac{2}{3} \times 1\frac{2}{3} =$ | $3\frac{2}{3} \times \frac{1}{2} =$ |
| **5.** | $\frac{3}{4} \times 2\frac{5}{6} =$ | $5\frac{2}{3} \times \frac{1}{2} =$ |
| **6.** | $\frac{7}{10} \times 3\frac{2}{3} =$ | $3\frac{1}{2} \times \frac{8}{9} =$ |
| **7.** | $\frac{1}{2} \times 4\frac{1}{3} =$ | $\frac{6}{7} \times 4\frac{2}{3} =$ |
| **8.** | $\frac{5}{6} \times 3\frac{7}{10} =$ | $5\frac{1}{6} \times \frac{14}{15} =$ |
| **9.** | $2\frac{1}{2} \times \frac{1}{3} =$ | $1\frac{3}{4} \times \frac{12}{21} =$ |
| **10.** | $\frac{3}{4} \times 2\frac{1}{2} =$ | $2\frac{3}{5} \times \frac{15}{26} =$ |
| **11.** | $\frac{4}{5} \times 4\frac{1}{6} =$ | $\frac{9}{10} \times 2\frac{2}{3} =$ |

# Factors named by mixed forms only

**1.** Dick says he can ride his bicycle at the rate of $9\frac{1}{2}$ miles an hour. At that rate, how far can he ride in $2\frac{1}{2}$ hours? ______ Complete the multiplication at the right.

$$2\frac{1}{2} \times 9\frac{1}{2} = \frac{5}{2} \times \frac{19}{2} = \frac{95}{4} =$$

**2.** Find the distance Tony can ride his bicycle in $2\frac{1}{2}$ hours at $8\frac{3}{4}$ miles an hour.

______ Complete the multiplication.

$$2\frac{1}{2} \times 8\frac{3}{4} =$$

Name all products in lowest terms. Use a shortcut whenever possible.

| | a | b |
|---|---|---|
| **3.** | $3\frac{1}{2} \times 2\frac{2}{3} = \frac{7}{\underset{1}{\cancel{2}}} \times \frac{\overset{4}{\cancel{8}}}{3} = \frac{28}{3} =$ | $3\frac{1}{4} \times 2\frac{1}{2} =$ |
| **4.** | $1\frac{2}{3} \times 4\frac{1}{5} = \frac{\overset{1}{\cancel{5}}}{\underset{1}{\cancel{3}}} \times \frac{\overset{7}{\cancel{21}}}{\underset{1}{\cancel{5}}} =$ | $8\frac{1}{3} \times 4\frac{1}{5} =$ |
| **5.** | $4\frac{2}{3} \times 3\frac{1}{2} =$ | $2\frac{2}{5} \times 5\frac{1}{2} =$ |
| **6.** | $1\frac{1}{2} \times 3\frac{1}{3} =$ | $3\frac{3}{4} \times 4\frac{2}{5} =$ |
| **7.** | $3\frac{1}{2} \times 2\frac{3}{4} =$ | $2\frac{2}{3} \times 1\frac{3}{4} =$ |
| **8.** | $8\frac{1}{3} \times 3\frac{1}{5} =$ | $3\frac{1}{2} \times 1\frac{5}{6} =$ |
| **9.** | $5\frac{1}{3} \times 2\frac{3}{4} =$ | $4\frac{7}{8} \times 1\frac{1}{3} =$ |
| **10.** | $3\frac{1}{2} \times 2\frac{1}{4} =$ | $3\frac{2}{3} \times 4\frac{4}{5} =$ |
| **11.** | $3\frac{3}{4} \times 5\frac{1}{3} =$ | $5\frac{1}{3} \times 1\frac{1}{8} =$ |
| **12.** | $8\frac{2}{3} \times 2\frac{1}{2} =$ | $9\frac{2}{3} \times 6\frac{3}{4} =$ |

# Reciprocals

— What number will make each sentence true?

| | a | b | c |
|---|---|---|---|
| **1.** | $\frac{1}{4} \times 4 = n \quad n = \_\_\_\_$ | $\frac{7}{8} \times \frac{8}{7} = n \quad n = \_\_\_\_$ | $\frac{1}{10} \times 10 = n \quad n = \_\_\_\_$ |
| **2.** | $\frac{17}{10} \times \frac{10}{17} = n \quad n = \_\_\_\_$ | $\frac{12}{13} \times \frac{13}{12} = n \quad n = \_\_\_\_$ | $\frac{17}{23} \times \frac{23}{17} = n \quad n = \_\_\_\_$ |
| **3.** | $123 \times \frac{1}{123} = n \quad n = \_\_\_\_$ | $\frac{111}{421} \times \frac{421}{111} = n \quad n = \_\_\_\_$ | $\frac{1}{500} \times 500 = n \quad n = \_\_\_\_$ |

Two numbers whose product is 1 are called reciprocals of each other.

— Ring each pair of numerals that name reciprocals of each other.

| | | | | | | |
|---|---|---|---|---|---|---|
| **4.** | $\frac{5}{9}$ $\frac{9}{5}$ | $8$ $\frac{1}{7}$ | $5$ $\frac{1}{5}$ | $1\frac{1}{2}$ $\frac{2}{3}$ | $10$ $\frac{5}{10}$ | $\frac{3}{4}$ $1\frac{1}{3}$ |
| **5.** | $\frac{3}{8}$ $\frac{3}{8}$ | $\frac{7}{12}$ $\frac{12}{7}$ | $\frac{1}{40}$ $40$ | $\frac{3}{11}$ $3\frac{2}{3}$ | $32$ $\frac{1}{32}$ | $1\frac{2}{5}$ $\frac{5}{2}$ |
| **6.** | $\frac{11}{32}$ $\frac{32}{11}$ | $\frac{1}{100}$ $100$ | $\frac{3}{50}$ $50$ | $\frac{11}{267}$ $\frac{11}{267}$ | $2\frac{2}{3}$ $\frac{3}{8}$ | $3\frac{3}{10}$ $\frac{10}{33}$ |

— What is the reciprocal of each number named below?

| | a | b | c | d | e |
|---|---|---|---|---|---|
| **7.** | $\frac{5}{8}$ ____ | $\frac{9}{4}$ ____ | $\frac{1}{7}$ ____ | $\frac{6}{5}$ ____ | $4$ ____ |
| **8.** | $\frac{2}{11}$ ____ | $5$ ____ | $\frac{7}{9}$ ____ | $\frac{11}{7}$ ____ | $\frac{1}{6}$ ____ |
| **9.** | $\frac{5}{12}$ ____ | $7$ ____ | $\frac{20}{13}$ ____ | $\frac{1}{14}$ ____ | $\frac{8}{3}$ ____ |
| **10.** | $1\frac{1}{2}$ ____ | $5\frac{2}{3}$ ____ | $4\frac{1}{5}$ ____ | $6\frac{2}{7}$ ____ | $3\frac{5}{8}$ ____ |
| **11.** | $2\frac{5}{6}$ ____ | $8\frac{3}{4}$ ____ | $10\frac{2}{9}$ ____ | $7\frac{2}{7}$ ____ | $5\frac{3}{8}$ ____ |
| **12.** | $9\frac{1}{4}$ ____ | $3\frac{9}{10}$ ____ | $4\frac{8}{11}$ ____ | $1\frac{11}{12}$ ____ | $2\frac{2}{13}$ ____ |

# Practice

— Solve each of these sentences. Express products in lowest terms.

| | a | b | c |
|---|---|---|---|
| **1.** | $\frac{2}{3} \times n = 1$ $n =$ ______ | $n \times \frac{8}{5} = 1$ $n =$ ______ | $2\frac{3}{4} \times n = 1$ $n =$ ______ |
| **2.** | $n \times 3\frac{2}{5} = 1$ $n =$ ______ | $n \times 7\frac{2}{9} = 1$ $n =$ ______ | $4\frac{2}{7} \times n = 1$ $n =$ ______ |
| **3.** | $\frac{n}{3} \times \frac{2}{7} = \frac{10}{21}$ $n =$ ______ | $\frac{8}{9} \times \frac{2}{n} = \frac{16}{63}$ $n =$ ______ | $\frac{2}{5} \times \frac{7}{n} = \frac{14}{15}$ $n =$ ______ |
| **4.** | $\frac{n}{4} \times \frac{5}{8} = \frac{15}{32}$ $n =$ ______ | $\frac{7}{n} \times \frac{3}{8} = \frac{21}{80}$ $n =$ ______ | $\frac{9}{11} \times \frac{3}{n} = \frac{27}{77}$ $n =$ ______ |

**5.** $\frac{5}{6} \times \frac{4}{7} = n$ $n =$ ______

**6.** $2\frac{1}{2} \times \frac{3}{10} = n$ $n =$ ______

**7.** $1\frac{2}{3} \times 2\frac{1}{2} = n$ $n =$ ______

**8.** $5\frac{2}{3} \times 12 = n$ $n =$ ______

**9.** $\frac{4}{9} \times \frac{3}{20} = n$ $n =$ ______

**10.** $\frac{7}{10} \times 18 = n$ $n =$ ______

**11.** $7\frac{1}{2} \times 2\frac{1}{3} = n$ $n =$ ______

**12.** $5\frac{1}{7} \times 1\frac{1}{8} = n$ $n =$ ______

**13.** $4\frac{2}{5} \times \frac{10}{14} = n$ $n =$ ______

**14.** $\frac{7}{8} \times 3\frac{3}{5} = n$ $n =$ ______

**15.** $1\frac{4}{5} \times \frac{4}{27} = n$ $n =$ ______

**5**

**6**

**7**

**8**

**9**

**10**

**11**

**12**

**13**

**14**

**15**

# Problem solving

**1.** If you buy eight rolls, what part of a dozen have you bought? _____ If the rolls cost 72¢ a dozen, how much should the eight rolls cost? _____

**2.** The distance from Westfield, New Jersey, to Chicago, Illinois, is 870 miles. If Mr. Stutz drove $\frac{2}{3}$ of the way on the first day, how far did he drive? ____________

**3.** Fran's skirt material costs $4.32 a yard. If she needs $1\frac{1}{2}$ yards, how much will the material cost? _____

**4.** A certain recipe calls for $\frac{3}{4}$ pound of chopped meat. If Bonnie wants to make $2\frac{1}{2}$ times the usual amount, how much chopped meat will she need? _____

**5.** On a 56-problem test, Dave got $\frac{7}{8}$ of the problems correct. How many problems did he do correctly? _____

**6.** Mrs. Newton cooked a $4\frac{3}{4}$-pound roast and the family ate $\frac{2}{3}$ of it. How many pounds did they eat? _____

**7.** Steven usually takes $1\frac{1}{3}$ hours to mow his lawn but because of interruptions it took $1\frac{1}{4}$ times as long. How many hours did it take? _____

**8.** If Mr. Steele drives for $3\frac{2}{3}$ hours at a rate of 45 miles an hour, how far will he drive? ____________

— Express each answer in lowest terms, if possible.

**9.** 6 ounces is what part of a pound? _____

**10.** 2 days is what part of a week? _____

**11.** 8 inches is what part of a foot? _____

**12.** 35 minutes is what part of an hour? _____

**13.** 9 hours is what part of a day? _____

**14.** 20 inches is what part of a yard? _____

**15.** 10 months is what part of a year? _____

**16.** 45 cents is what part of a dollar? _____

| | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | 10 |
| 11 | 12 |
| 13 | 14 |
| 15 | 16 |

# Simplifying complex fractions

In simplifying the complex fraction at the right, the number used as a factor ($\frac{2}{3}$) is the reciprocal of the denominator shown in the complex fraction ($\frac{3}{2}$).

$$\frac{\frac{5}{8}}{\frac{3}{2}} = \frac{\frac{2}{3} \times \frac{5}{8}}{\frac{2}{3} \times \frac{3}{2}} = \frac{\frac{10}{24}}{1} = \frac{10}{24}, \text{ or } \frac{5}{12}$$

— Simplify each of the following complex fractions. Name your answer in lowest terms.

| | a | b |
|---|---|---|
| 1. | $\frac{\frac{2}{3}}{\frac{3}{4}} =$ | $\frac{\frac{9}{10}}{\frac{1}{3}} =$ |
| 2. | $\frac{\frac{5}{8}}{\frac{1}{2}} =$ | $\frac{\frac{6}{7}}{\frac{3}{8}} =$ |
| 3. | $\frac{\frac{7}{8}}{\frac{2}{3}} =$ | $\frac{\frac{2}{11}}{\frac{2}{9}} =$ |
| 4. | $\frac{\frac{1}{2}}{\frac{3}{5}} =$ | $\frac{\frac{7}{12}}{\frac{3}{5}} =$ |
| 5. | $\frac{8}{\frac{2}{7}} =$ | $\frac{\frac{4}{5}}{11} =$ |
| 6. | $\frac{\frac{4}{9}}{5} =$ | $\frac{6}{\frac{2}{7}} =$ |
| 7. | $\frac{\frac{11}{12}}{\frac{1}{9}} =$ | $\frac{\frac{1}{7}}{\frac{3}{4}} =$ |
| 8. | $\frac{\frac{5}{8}}{\frac{1}{12}} =$ | $\frac{\frac{7}{8}}{\frac{7}{8}} =$ |
| 9. | $\frac{14}{\frac{8}{9}} =$ | $\frac{\frac{7}{11}}{3} =$ |
| 10. | $\frac{\frac{2}{5}}{\frac{7}{15}} =$ | $\frac{\frac{9}{16}}{\frac{3}{4}} =$ |

# Using reciprocals to divide fractional numbers

**1.** To solve the sentence, $\frac{1}{5} \div \frac{3}{8} = n$, first study the true sentence at the right.

- Are $\frac{3}{8}$ and $\frac{8}{3}$ reciprocals ? _____
- Does $\frac{1}{5} \times \frac{8}{3}$ name the same number as $\frac{1}{5} \div \frac{3}{8}$?

  _____
- Then to divide $\frac{1}{5}$ by $\frac{3}{8}$, you can find the product of $\frac{1}{5}$ and $\frac{8}{3}$.

$$\frac{1}{5} \div \frac{3}{8} = \frac{\frac{1}{5}}{\frac{3}{8}} = \frac{\frac{1}{5} \times \frac{8}{3}}{\frac{3}{8} \times \frac{8}{3}} = \frac{1}{5} \times \frac{8}{3}$$

Solution: $\frac{1}{5} \times \frac{8}{3} = \frac{8}{15}$

Check: $\frac{\overset{1}{\cancel{8}}}{\underset{5}{\cancel{15}}} \times \frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{8}}} = \frac{1}{5}$

Answer: $n = \frac{8}{15}$

**2.** Study the solution and the check.

— Solve each of these sentences. Name all answers in lowest terms. Then multiply to check.

**3.** $\frac{4}{9} \div \frac{6}{7} = m$ Solution: $m =$ _____

Check:

**4.** $\frac{3}{4} \div \frac{7}{8} = a$ Solution: $a =$ _____

Check:

**5.** $\frac{5}{12} \div \frac{10}{11} = t$ Solution: $t =$ _____

Check:

**6.** $\frac{3}{20} \div \frac{4}{5} = h$ Solution: $h =$ _____

Check:

**7.** $\frac{5}{8} \div \frac{1}{4} = m$ Solution: $m =$ _____

Check:

**8.** $\frac{6}{11} \div \frac{6}{11} = a$ Solution: $a =$ _____

Check:

**9.** $\frac{2}{3} \div \frac{3}{2} = t$ Solution: $t =$ _____

Check:

**10.** $\frac{7}{16} \div \frac{3}{4} = h$ Solution: $h =$ _____

Check:

# Dividing fractional numbers

— Solve each of these sentences. Name all answers in lowest terms.

| | a | b |
|---|---|---|
| **1.** | $\frac{7}{10} \div \frac{5}{6} =$ | $\frac{9}{14} \div \frac{3}{7} =$ |
| **2.** | $\frac{3}{4} \div \frac{1}{6} =$ | $\frac{4}{15} \div \frac{2}{5} =$ |
| **3.** | $\frac{3}{10} \div \frac{1}{3} =$ | $\frac{3}{4} \div \frac{5}{6} =$ |
| **4.** | $\frac{2}{7} \div \frac{6}{13} =$ | $\frac{1}{6} \div \frac{2}{9} =$ |
| **5.** | $\frac{7}{12} \div \frac{1}{6} =$ | $\frac{5}{16} \div \frac{1}{10} =$ |
| **6.** | $\frac{4}{9} \div \frac{4}{5} =$ | $\frac{3}{11} \div \frac{5}{22} =$ |
| **7.** | $\frac{8}{15} \div \frac{7}{10} =$ | $\frac{8}{13} \div \frac{8}{13} =$ |
| **8.** | $\frac{9}{16} \div \frac{3}{8} =$ | $\frac{2}{3} \div \frac{7}{12} =$ |

**9.** How many first-aid bandages $\frac{1}{8}$ yard wide can Tim tear from a piece of gauze $\frac{3}{4}$ yard wide? ______

**10.** Using a scale of $\frac{1}{16}$ inch to one mile, how long a distance is represented by a line segment $\frac{7}{8}$ inch long? ______

**11.** The boys in a science class have $\frac{3}{4}$ ounce of powdered sulphur which they want to put into small envelopes, each holding one teaspoonful, or $\frac{1}{6}$ ounce. How many teaspoonfuls of sulphur will they have? ______

**12.** If one quart of water is needed for $\frac{1}{3}$ cup of plant food, how many quarts are needed for $\frac{3}{4}$ cup of food? ______

| |
|---|
| **9** |
| **10** |
| **11** |
| **12** |

# Practice

Remember: if $\frac{a}{b} \times \frac{c}{d} = \frac{x}{y}$ then $\frac{a}{b} = \frac{x}{y} \div \frac{c}{d}$ and $\frac{c}{d} = \frac{x}{y} \div \frac{a}{b}$

— With this in mind, solve these sentences. Name all answers in lowest terms. The first one is done for you.

**1.** $\frac{6}{7} \times a = \frac{3}{4}$ $\frac{3}{4} \div \frac{6}{7} = \frac{\overset{1}{\cancel{3}}}{4} \times \frac{7}{\underset{2}{\cancel{6}}} = \frac{7}{8}$ $a = \frac{7}{8}$

**2.** $\frac{2}{5} \times b = \frac{5}{8}$ $b =$ ______

**3.** $c \times \frac{3}{5} = \frac{1}{2}$ $c =$ ______

**4.** $d \times \frac{8}{9} = \frac{4}{15}$ $d =$ ______

**5.** $\frac{3}{10} \times e = \frac{7}{20}$ $e =$ ______

**6.** $f \times \frac{1}{3} = \frac{5}{12}$ $f =$ ______

**7.** $\frac{5}{8} \times g = \frac{3}{10}$ $g =$ ______

**8.** $a \times \frac{6}{11} = \frac{3}{22}$ $a =$ ______

**9.** $\frac{3}{4} \times b = \frac{9}{14}$ $b =$ ______

**10.** $c \times \frac{1}{6} = \frac{7}{9}$ $c =$ ______

**11.** $\frac{11}{12} \times d = \frac{3}{20}$ $d =$ ______

**12.** $e \times \frac{3}{8} = \frac{5}{16}$ $e =$ ______

**13.** $\frac{10}{13} \times f = \frac{10}{11}$ $f =$ ______

**14.** $g \times \frac{4}{15} = \frac{6}{25}$ $g =$ ______

# Dividing fractional numbers named by mixed forms

**1.** The Boy Scouts of Franklin School climbed Mt. York to have a picnic. The trail was only $\frac{3}{4}$ mile long, but it was so steep that the Scouts spent $1\frac{1}{2}$ hours on the climb. To find their average rate per hour, you need to divide $\frac{3}{4}$ by $1\frac{1}{2}$.

Study and complete the solution in the box.

Their average rate was _____ mile per hour.

$$\frac{3}{4} \div 1\frac{1}{2} = \frac{3}{4} \div \frac{3}{2} = \frac{\overset{1}{\cancel{3}}}{\underset{2}{\cancel{4}}} \times \frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{3}}} = \underline{\qquad}$$

**2.** Out of $1\frac{3}{4}$ ounces of yarn Peggy knitted $3\frac{1}{2}$ flowers. To find how much yarn she used for one flower, you need to divide $1\frac{3}{4}$ by $3\frac{1}{2}$.

Study and complete the solution in the box.

Peggy used _____ ounce of yarn for one flower.

$$1\frac{3}{4} \div 3\frac{1}{2} = \frac{7}{4} \div \frac{7}{2} = \frac{\overset{1}{\cancel{7}}}{\underset{2}{\cancel{4}}} \times \frac{\overset{1}{\cancel{2}}}{\underset{1}{\cancel{7}}} = \underline{\qquad}$$

— Solve these sentences. Name all answers in lowest terms.

| | a | b |
|---|---|---|
| **3.** | $2\frac{2}{3} \div \frac{5}{9} =$ | $2\frac{5}{8} \div 1\frac{1}{2} =$ |
| **4.** | $1\frac{3}{4} \div 2\frac{1}{2} =$ | $3\frac{2}{5} \div \frac{3}{10} =$ |
| **5.** | $\frac{4}{9} \div 2\frac{5}{6} =$ | $5\frac{2}{3} \div 4\frac{1}{4} =$ |
| **6.** | $6\frac{2}{5} \div \frac{10}{15} =$ | $\frac{7}{12} \div 3\frac{3}{4} =$ |
| **7.** | $4\frac{1}{2} \div 2\frac{1}{4} =$ | $7\frac{2}{3} \div \frac{5}{12} =$ |
| **8.** | $\frac{5}{24} \div 1\frac{5}{6} =$ | $1\frac{2}{7} \div 2\frac{1}{4} =$ |
| **9.** | $3\frac{2}{5} \div 3\frac{4}{10} =$ | $10\frac{1}{2} \div 1\frac{3}{4} =$ |

# Practice

— Solve these sentences. Name all answers in lowest terms.

| | a | b |
|---|---|---|
| **1.** | $\frac{2}{9} \div \frac{4}{15} =$ | $\frac{7}{10} \div \frac{3}{5} =$ |
| **2.** | $\frac{5}{6} \div 1\frac{2}{3} =$ | $\frac{3}{10} \div 3\frac{1}{5} =$ |
| **3.** | $5\frac{2}{3} \div 6\frac{1}{6} =$ | $3\frac{2}{5} \div 4\frac{1}{10} =$ |
| **4.** | $6\frac{7}{8} \div 2\frac{3}{4} =$ | $4\frac{2}{3} \div 1\frac{5}{6} =$ |
| **5.** | $2\frac{5}{8} \div \frac{7}{16} =$ | $\frac{4}{9} \div 1\frac{2}{3} =$ |

**6.** $\frac{3}{4} \times n = \frac{1}{2}$ $n =$ _____

**7.** $\frac{7}{8} \times n = \frac{3}{10}$ $n =$ _____

**8.** $1\frac{1}{2} \times n = \frac{7}{8}$ $n =$ _____

**9.** $n \times 2\frac{1}{4} = \frac{5}{6}$ $n =$ _____

**10.** $4\frac{1}{3} \times n = 6\frac{5}{12}$ $n =$ _____

**11.** $2\frac{3}{8} \times n = \frac{5}{16}$ $n =$ _____

**12.** $n \times 1\frac{4}{5} = 2\frac{3}{10}$ $n =$ _____

**13.** $n \times 1\frac{5}{6} = 2\frac{7}{12}$ $n =$ _____

**14.** $3\frac{4}{5} \times n = \frac{7}{15}$ $n =$ _____

**15.** $6\frac{2}{7} \times n = \frac{5}{21}$ $n =$ _____

# Dividing a whole number by a fractional number

**1.** To divide 10 by $\frac{3}{4}$, study and complete the solution below.

$$10 \div \frac{3}{4} = \frac{10}{1} \times \frac{4}{3} = \frac{40}{3} = \underline{\qquad}$$

**2.** To divide 8 by $2\frac{1}{3}$, rename $2\frac{1}{3}$ as $\frac{7}{3}$. Study and complete the solution below.

$$8 \div 2\frac{1}{3} = 8 \div \frac{7}{3} = \frac{8}{1} \times \frac{3}{7} = \frac{24}{7} = \underline{\qquad}$$

— Solve these sentences. Name your answers in lowest terms.

| | a | b |
|---|---|---|
| **3.** | $5 \div \frac{2}{3} =$ | $8 \div \frac{3}{5} =$ |
| **4.** | $15 \div \frac{3}{4} =$ | $18 \div \frac{3}{9} =$ |
| **5.** | $9 \div 1\frac{1}{2} =$ | $12 \div 1\frac{4}{5} =$ |
| **6.** | $10 \div 6\frac{2}{3} =$ | $18 \div 6\frac{3}{4} =$ |

**7.** Betty bought $1\frac{1}{2}$ pounds of fruitcake for \$1.68. To find how much she paid per pound, you need to divide \$1.68 by $1\frac{1}{2}$.

Study and complete the solution at the right.

$$168 \div 1\frac{1}{2} = \frac{168}{1} \div \frac{3}{2} = \frac{\overset{56}{\cancel{168}}}{1} \times \frac{2}{\underset{1}{\cancel{3}}} = \underline{\qquad}$$

The fruitcake cost \$ . ______ per pound.

— Name all answers in lowest terms. Use a dollar sign and a cents point.

| | | |
|---|---|---|
| **8.** | $\$3.50 \div 2\frac{1}{3} =$ | $\$1.35 \div 2\frac{1}{4} =$ |
| **9.** | $\$1.86 \div 1\frac{1}{5} =$ | $\$2.79 \div 4\frac{1}{2} =$ |
| **10.** | $\$3.50 \div 1\frac{3}{4} =$ | $\$5.00 \div 2\frac{1}{2} =$ |
| **11.** | $\$6.00 \div 3\frac{1}{3} =$ | $\$4.30 \div 1\frac{3}{7} =$ |
| **12.** | $\$6.50 \div 1\frac{2}{3} =$ | $\$1.80 \div 3\frac{3}{4} =$ |

# Dividing a fractional number by a whole number

**1.** To divide $\frac{2}{3}$ by 3, study and complete the solution below.

$$\frac{2}{3} \div 3 = \frac{2}{3} \times \frac{1}{3} = \underline{\qquad}$$

**2.** To divide $3\frac{1}{2}$ by 2, rename $3\frac{1}{2}$ as $\frac{7}{2}$. Study and complete the solution below.

$$3\tfrac{1}{2} \div 2 = \frac{7}{2} \div \frac{2}{1} = \frac{7}{2} \times \frac{1}{2} = \frac{7}{4} = \underline{\qquad}$$

— Solve each sentence. Name your answer in lowest terms.

| | a | b |
|---|---|---|
| **3.** | $\frac{5}{8} \div 15 =$ | $\frac{3}{10} \div 12 =$ |
| **4.** | $\frac{6}{7} \div 9 =$ | $\frac{3}{4} \div 18 =$ |
| **5.** | $\frac{7}{20} \div 2 =$ | $\frac{8}{15} \div 14 =$ |
| **6.** | $\frac{15}{17} \div 10 =$ | $\frac{10}{21} \div 8 =$ |
| **7.** | $1\frac{1}{2} \div 9 =$ | $5\frac{2}{3} \div 4 =$ |
| **8.** | $3\frac{1}{4} \div 6 =$ | $2\frac{5}{6} \div 17 =$ |
| **9.** | $4\frac{1}{5} \div 3 =$ | $6\frac{2}{3} \div 8 =$ |
| **10.** | $10\frac{1}{2} \div 4 =$ | $2\frac{3}{5} \div 2 =$ |
| **11.** | $7\frac{1}{3} \div 12 =$ | $4\frac{2}{3} \div 10 =$ |
| **12.** | $1\frac{1}{4} \div 7 =$ | $3\frac{3}{5} \div 4 =$ |

**13.** Ann has $8\frac{3}{4}$ yards of ribbon to tie 5 gift boxes. How much ribbon can she use for each box? ______

**14.** How many tickets $1\frac{3}{4}$ inches long can John cut from a strip of cardboard 35 inches long? ______

**13**

**14**

# Problem solving

— Solve each problem. Use a division sentence if it will help you.

**1.** A certain postage stamp is $\frac{7}{8}$ inch long. How many would be in a row $15\frac{3}{4}$ inches long? _____

**2.** If it takes Ted $\frac{3}{4}$ hour to cut a lawn, how many similar lawns could he cut in $7\frac{1}{2}$ hours? _____

**3.** Tom swam 200 yards in $2\frac{1}{2}$ minutes. His rate of swimming was _____ yards per minute.

**4.** Certain homes are built on $1\frac{1}{4}$ acres of land. How many homes could be built on $22\frac{1}{2}$ acres? _____

**5.** Steve can walk 1 block in $1\frac{1}{3}$ minutes. How many blocks could he walk in 16 minutes? _____

**6.** The 300-yard relay race was won in $3\frac{1}{3}$ minutes. The rate of the winning team was _____ yards per minute.

**7.** Mrs. May put $\frac{3}{16}$ pound of candy in each Halloween bag. With 6 pounds of candy she can fill _____ bags.

**8.** Bobby can read 1 page in his book in $1\frac{1}{8}$ minutes. How many pages should he read in $24\frac{3}{4}$ minutes? _____

**9.** David was paid $2.00 for cutting the grass. If he worked $1\frac{2}{3}$ hours, how much did he earn per hour? _____

**10.** How many pieces of string $5\frac{3}{4}$ inches long could be cut from a piece of string $40\frac{1}{4}$ inches long? _____

**11.** Fran has $2\frac{1}{2}$ pounds of dog food. If her puppy eats $\frac{5}{8}$ pound per day, how many days will the food last? _____

**12.** A plane flew from New York to Boston, about 230 miles, in $1\frac{1}{3}$ hours. It flew at the rate of _____ miles per hour.

| |
|---|
| **1** |
| **2** |
| **3** |
| **4** |
| **5** |
| **6** |
| **7** |
| **8** |
| **9** |
| **10** |
| **11** |
| **12** |

# Review

**1.**
$$\begin{array}{r} 287 \\ 359 \\ 142 \\ +206 \\ \hline \end{array}$$

**2.**
$$\begin{array}{r} 567 \\ 254 \\ 923 \\ +760 \\ \hline \end{array}$$

**3.**
$$\begin{array}{r} 4{,}207 \\ 839 \\ 1{,}234 \\ +3{,}131 \\ \hline \end{array}$$

**4.**
$$\begin{array}{r} \$49.95 \\ 65.00 \\ 29.69 \\ +37.84 \\ \hline \end{array}$$

**5.**
$$\begin{array}{r} 871 \\ -493 \\ \hline \end{array}$$

**6.**
$$\begin{array}{r} \$7.50 \\ -3.86 \\ \hline \end{array}$$

**7.**
$$\begin{array}{r} 5{,}070 \\ -2{,}987 \\ \hline \end{array}$$

**8.**
$$\begin{array}{r} \$37.84 \\ -16.95 \\ \hline \end{array}$$

**9.** $214_{five} =$ ______

**10.** $423_{five} =$ ______

**11.** $37 =$ ______$_{five}$

**12.** $53 =$ ______$_{five}$

**13.** Rename using Roman numerals.

678 ________ 1,924________

**14.** Rename using decimal numerals.

DCL ______ DXLIX ______

**15.** A = {0, 1, 2, 3}
B = {2, 3, 4, 5}
C = {4, 5, 6, 7}

$A \cap B =$ ______
$A \cap C =$ ______
$B \cap C =$ ______

$A \cup B =$ ________________
$A \cup C =$ ________________
$B \cup C =$ ________________

**16.** $46\overline{)6{,}072}$

**17.** $39\overline{)10{,}456}$

**18.** $58\overline{)\$509.82}$

**19.** $873\overline{)268{,}011}$

**20.**
$$\begin{array}{r} 2 \text{ hr. } 43 \text{ min.} \\ +3 \text{ hr. } 39 \text{ min.} \\ \hline \end{array}$$

**21.**
$$\begin{array}{r} 5 \text{ ft. } 4 \text{ in.} \\ -3 \text{ ft. } 7 \text{ in.} \\ \hline \end{array}$$

**22.**
$$\begin{array}{r} 6 \text{ lb. } 3 \text{ oz.} \\ \times 8 \\ \hline \end{array}$$

**23.** $3\overline{)4 \text{ qt. } 1 \text{ pt.}}$

**24.** Round 5,847 to the nearest:

ten ________ hundred ________ thousand ________ ten thousand ________

# Problem Test 4

**1.** Dave is $61\frac{1}{4}$ inches tall. His brother Joe is $49\frac{3}{4}$ inches tall. How much taller is Dave than Joe? ______

**2.** For the school fair, Miss Walter's class spent $7.14 for 42 plants. If they sell all the plants for 29¢ each, how much profit will they make? ______

**3.** The winner of a swimming race swam 300 yards in $3\frac{1}{3}$ minutes. What was his rate in yards per minute? ______

**4.** A 400-yard relay race was won in $4\frac{2}{3}$ minutes. The rate of the winning team was ______ yards per minute.

**5.** A blue jay can fly 26 miles in an hour. At that rate how far can it fly in 15 minutes? ______

**6.** Harry had a rope $52\frac{1}{4}$ feet long. He cut off a piece to tie a boat to a landing. He has $34\frac{1}{2}$ feet of rope left. How much did he use to tie the boat? ______

**7.** Bill bought a badminton net for $1.17, two rackets for $2.87, and a dozen shuttlecocks at 6 for $.82. How much change should he get from $10.00? ______

**8.** In $4\frac{1}{2}$ minutes 225 gallons of water were pumped into a swimming pool. The water was pumped at the rate of how many gallons per minute? ______

**9.** If pot roasts are on sale for 74¢ a pound, how much would a $6\frac{3}{4}$-pound roast cost? ______

**10.** Kenneth has $1\frac{3}{4}$ pounds of seed. How many packages of seed can he make if he puts 2 ounces in each package? ______

Number correct: ______. Date: ____________ ____, ______.
Write your score on the Problem Test Record on page 160. Fill in the fourth bar in the Problem Test Graph on page 160.

**1**
**2**
**3**
**4**
**5**
**6**
**7**
**8**
**9**
**10**

## Review

**1.** $\begin{array}{r} 246\\ 328\\ 790\\ 565\\ +439\\ \hline \end{array}$ $\qquad$ $\begin{array}{r} \$5.84\\ .27\\ 6.35\\ .49\\ +2.87\\ \hline \end{array}$ $\qquad$ $\begin{array}{r} 5,643\\ 1,475\\ 9,208\\ 2,476\\ +8,035\\ \hline \end{array}$

**2.** $\begin{array}{r} 775\\ -639\\ \hline \end{array}$ $\qquad$ $\begin{array}{r} \$8.07\\ -.78\\ \hline \end{array}$ $\qquad$ $\begin{array}{r} \$90.05\\ -3.84\\ \hline \end{array}$

**3.** $432\overline{)8,769}$ $\qquad$ $46\overline{)28,750}$

**4.** $2\frac{1}{3} \times \frac{4}{7} =$

**5.** $9\frac{1}{3} \times 6\frac{3}{4} =$

**6.** $\begin{array}{r} 1\frac{2}{3}\\ +2\frac{3}{4}\\ \hline \end{array}$ $\qquad$ $\begin{array}{r} 9\frac{1}{5}\\ -6\frac{1}{2}\\ \hline \end{array}$

**7.** $\begin{array}{r} 379\\ \times 305\\ \hline \end{array}$ $\qquad$ $\begin{array}{r} 986\\ \times 470\\ \hline \end{array}$ $\qquad$ $\begin{array}{r} 907\\ \times 385\\ \hline \end{array}$

## Progress Test 4

**1.** $\frac{3}{4} \div \frac{1}{3} =$

**2.** $4\frac{1}{2} \div \frac{3}{4} =$

**3.** $\frac{7}{8} \div 2\frac{1}{2} =$

**4.** $\frac{8}{9} \div 8 =$

**5.** $\$6.00 \div 1\frac{1}{3} =$

**6.** $7\frac{1}{2} \div 2\frac{1}{4} =$

**7.** In a reading test Dan read 700 words in $1\frac{3}{4}$ minutes. His reading was at the rate of ______ words per minute.

**8.** Ray walked $10\frac{1}{8}$ miles in $2\frac{1}{4}$ hours. He walked at the rate of ______ miles per hour.

**9.** Sam bought a $3\frac{1}{2}$-yard roll of heavy gummed tape. How many $\frac{1}{4}$-yard pieces can he cut from it? ______

**10.** Susan uses $1\frac{2}{3}$ cups of milk to make a pudding. How much milk does she need to triple the recipe? ______

WORK SPACE

Number correct: ______. Date: ______________ ____, ________.
Write your score on the Progress Test Record on page 160. Fill in the fourth bar in the Progress Test Graph form on page 160.

# Fractional numbers named by decimals

**1.** Study and complete the table below.

| Fraction or Mixed form | $\frac{3}{10}$ | $\frac{9}{10}$ | $\frac{25}{100}$ | $\frac{63}{100}$ | $\frac{7}{1,000}$ | $\frac{600}{1,000}$ | $2\frac{7}{10}$ | $5\frac{1}{10}$ | $4\frac{57}{100}$ | $9\frac{18}{100}$ | $6\frac{831}{1,000}$ | $7\frac{387}{1,000}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Decimal | 0.3 | | | | | | | | | | | |

**2.** A ________ is another way of naming a fractional number.

**3.** The first digit to the right of the decimal point is in the ________ place.

**4.** The second digit to the right of the point is in the ________ place.

**5.** The third digit to the right of the point is in the ________ place.

Study the pairs of examples in boxes A and B. Notice where the decimal point is placed in the answers.

**A**

$$\begin{array}{r} 5\frac{18}{100} \\ +\,4\frac{42}{100} \\ \hline 9\frac{60}{100} \end{array} \qquad \begin{array}{r} 5.18 \\ +\,4.42 \\ \hline 9.60 \end{array}$$

**B**

$$\begin{array}{r} 5\frac{7}{10} \\ -\,2\frac{3}{10} \\ \hline 3\frac{4}{10} \end{array} \qquad \begin{array}{r} 5.7 \\ -\,2.3 \\ \hline 3.4 \end{array}$$

Complete these examples. Be sure your decimal point is placed properly.

| | a | b | c | d | e |
|---|---|---|---|---|---|
| **6.** | 5.6<br>2.3<br>+4.7 | 8.7<br>6.2<br>+2.2 | 3.04<br>5.12<br>+8.99 | 1.357<br>2.876<br>+7.245 | 8.995<br>4.760<br>+3.075 |
| **7.** | 9.8<br>−2.4 | 16.5<br>−11.6 | 6.42<br>−3.25 | 8.16<br>−2.09 | 14.423<br>−11.247 |

Solve these sentences.

**8.** 5.27 − 2.18 = ____

**9.** 12.26 + 8.49 = ____

**10.** 15.147 + 91.286 + 7.341 = ____

**11.** 28.54 − 17.38 = ____

**12.** 18.48 − 6.92 = ____

**13.** 8.47 + 9.29 + 12.36 + 6.58 = ____

| 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|
| | | | | | |

## Practice

— Solve these number sentences.

**1.** $7.60 - 4.37 =$ ____

**2.** $15.36 - 12.87 =$ ____

**3.** $47.341 + 19.247 =$ ____

**4.** $18.92 - 11.24 =$ ____

**5.** $24.\ 92 - 13.33 =$ ____

**6.** $16.012 + 13.550 =$ ____

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | | | | |

**7.** $27.502 + 18.339 =$ ____

**8.** $32.721 - 15.132 =$ ____

**9.** $19.878 - 13.590 =$ ____

**10.** $14.581 + 10.264 =$ ____

**11.** $17.813 - 12.444 =$ ____

**12.** $38.491 - 17.205 =$ ____

| 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|
| | | | | | |

**13.** $7.36 + 6.32 + 3.95 =$ ____

**14.** $6.692 + 2.148 + 7.760 =$ ____

**15.** $4.581 + 3.100 + 2.299 =$ ____

**16.** $5.504 + 6.407 + 2.707 =$ ____

| |
|---|
| 13 |
| 14 |
| 15 |
| 16 |

To find the number for $n$ that makes $3.7 + n = 5.8$ a true sentence, you should solve $5.8 - 3.7 = n$. $n = 2.1$

— Solve these sentences.

| | a | | b | |
|---|---|---|---|---|
| **17.** | $5.4 + n = 8.9$ | ____ | $2.4 + n = 8.3$ | ____ |
| **18.** | $4.2 + n = 9.8$ | ____ | $n + 6.1 = 9.9$ | ____ |
| **19.** | $n + 2.3 = 5.7$ | ____ | $7.7 + n = 16.5$ | ____ |
| **20.** | $6.4 + n = 12.1$ | ____ | $n + 5.9 = 13.7$ | ____ |

WORK SPACE

# Solving number sentences

— Find the number that will make each sentence true.

**1.** $5.26 + n = 9.42$

$n =$ ______

**2.** $8.34 - m = 2.65$

$m =$ ______

**3.** $a - 7.2 = 2.4$

$a =$ ______

**4.** $b + 8.4 = 12.7$

$b =$ ______

**5.** $6.457 + w = 9.668$

$w =$ ______

**6.** $14.271 - t = 7.593$

$t =$ ______

**7.** $15.64 + 8.20 = c$

$c =$ ______

**8.** $24.9 - 6.3 = d$

$d =$ ______

**9.** $\$8.72 + \$4.23 = e$

$e =$ ______

**10.** $\$15.16 - \$7.84 = f$

$f =$ ______

**11.** $\$16.40 + g = \$20.00$

$g =$ ______

**12.** $\$4.12 - h = \$2.53$

$h =$ ______

**13.** $\$19.12 - j = \$14.68$

$j =$ ______

**14.** $\$17.13 + k = \$19.68$

$k =$ ______

**15.** $\$84.53 + \$12.58 = p$

$p =$ ______

**16.** $\$13.12 - \$11.31 = q$

$q =$ ______

**17.** $\$42.42 - \$18.19 = r$

$r =$ ______

**18.** $\$49.06 + \$71.17 = s$

$s =$ ______

**19.** $\$15.49 + y = \$30.17$

$y =$ ______

**20.** $\$71.35 - z = \$43.74$

$z =$ ______

| | |
|---|---|
| 1 | 11 |
| 2 | 12 |
| 3 | 13 |
| 4 | 14 |
| 5 | 15 |
| 6 | 16 |
| 7 | 17 |
| 8 | 18 |
| 9 | 19 |
| 10 | 20 |

# Multiplying by 10, 100, and 1,000

| | | | |
|---|---|---|---|
| **1.** | 10 × 3.678 = 36.78 | 100 × 3.678 = 367.8 | 1,000 × 3.678 = 3,678 |

- To multiply 3.678 by 10 move the decimal point _____ place to the right.
- To multiply 3.678 by 100 move the decimal point _____ places to the right.
- To multiply 3.678 by 1,000 move the decimal point _____ places to the right.

— Solve these number sentences. The first two in column **a** are done for you.

| | **a** | **b** |
|---|---|---|
| **2.** | 9.67 × 10 = 96.7 | 1.123 × _____ = 1,123 |
| **3.** | 5.64 × 1,000 = 5,640 | 0.123 × 10 = _______ |
| **4.** | 4.2 × _____ = 420 | 81 × _____ = 8,100 |
| **5.** | 4.237 × 100 = _______ | 6.7 × 1,000 = _______ |
| **6.** | 0.246 × _____ = 24.6 | 0.31 × _____ = 310 |
| **7.** | 51.32 × 1,000 = _______ | 16.8 × 10 = _______ |
| **8.** | 2.54 × _____ = 254 | 3.3 × _____ = 3,300 |
| **9.** | 621.87 × 10 = _______ | 35.5 × 100 = _______ |
| **10.** | 11.111 × _____ = 1,111.1 | 2.9 × _____ = 29 |
| **11.** | 7.3 × 1,000 = _______ | 0.4 × 100 = _______ |
| **12.** | 10 × _____ = 32.1 | 100 × _______ = 12.34 |
| **13.** | 1,000 × _______ = 5,416 | 10 × _______ = 5 |
| **14.** | 100 × _______ = 0.6 | 1,000 × _______ = 4.4 |
| **15.** | 10 × _______ = 74 | 100 × _______ = 5,678 |
| **16.** | 1,000 × _______ = 10 | 10 × _______ = 0.61 |

WORK SPACE

# Dividing by 10, 100, and 1,000

| | | | |
|---|---|---|---|
| 1. | 824.7 ÷ 10 = 82.47 | 824.7 ÷ 100 = 8.247 | 824.7 ÷ 1,000 = 0.8247 |

- To divide 824.7 by 10 move the decimal point ____ place to the left.
- To divide 824.7 by 100 move the decimal point ____ places to the left.
- To divide 824.7 by 1,000 move the decimal point ____ places to the left.

— Solve these number sentences. The first one is done for you.

| | a | b |
|---|---|---|
| 2. | 5,479 ÷ 100 = 54.79 | 283 ÷ 10 = ______ |
| 3. | 78 ÷ 1,000 = ______ | 24.63 ÷ 10 = ______ |
| 4. | 3.92 ÷ 100 = ______ | 1.1 ÷ 1,000 = ______ |
| 5. | 13,579 ÷ 1,000 = ______ | 51,358 ÷ 100 = ______ |
| 6. | 4,862 ÷ 10 = ______ | 3 ÷ 1,000 = ______ |
| 7. | 2 ÷ 100 = ______ | 8 ÷ 10 = ______ |
| 8. | 472.3 ÷ 1,000 = ______ | 54,928.1 ÷ 10 = ______ |
| 9. | 879.6 ÷ 100 = ______ | 2.3 ÷ 100 = ______ |
| 10. | 84.9 ÷ ____ = 0.849 | 5.6 ÷ ____ = 0.56 |
| 11. | 14.5 ÷ ____ = 0.0145 | 19 ÷ ____ = 1.9 |
| 12. | 724 ÷ ____ = 7.24 | 0.8 ÷ ____ = 0.008 |
| 13. | 10.3 ÷ ____ = 0.0103 | 210.3 ÷ ____ = 2.103 |
| 14. | ______ ÷ 10 = 52.3 | ______ ÷ 1,000 = 1.8 |
| 15. | ______ ÷ 100 = 2.424 | ______ ÷ 10 = 0.07 |
| 16. | ______ ÷ 1,000 = 9 | ______ ÷ 100 = 0.4 |

WORK SPACE

# Multiplying and dividing by 10, 100, and 1,000

**1.** Complete the table below.

| $n$ | $n \div 10$ | $n \div 100$ | $n \div 1{,}000$ | $n \times 10$ | $n \times 100$ | $n \times 1{,}000$ |
|---|---|---|---|---|---|---|
| 587.63 | | | | | | |
| 27 | | | | | | |
| 0.42 | | | | | | |
| | | | | 31.2 | | |
| | 2.38 | | | | | |
| | | | | | | 88 |
| | | | 7.425 | | | |
| | | 0.56 | | | | |

— Solve these problems. Use a number sentence if it will help you.

WORK SPACE

**2.** If Mr. Spence drove 4,987.2 miles in 10 days, how many miles did he average per day? ____________

**3.** A certain grade of gasoline costs 33.9¢ a gallon. How many cents would 100 gallons cost? ____________

How many dollars would that be? ____________

**4.** Each pound of pure water contains 0.11188 pounds of hydrogen. How many pounds of hydrogen would be in 1,000 pounds of water? ____________

**5.** If one meter makes approximately 39.37 inches, how many inches would make:

(a) 100 meters? ______

(b) one-tenth of a meter? ______

(c) 1,000 meters? ______

(d) one-hundredth of a meter? ______

# Products of fractional numbers named by decimals

In multiplication of numbers named by decimals there should be as many decimal places in the numeral for the product as there are decimal places in the numerals for the factors.

**1.** The examples shown below are not finished. Place the decimal point where it should be in each product.

| A | B | C | D |
|---|---|---|---|
| 8.15 | 2.41 | 24.8 | 72.34 |
| ×25 | × 3.2 | ×2.9 | ×2.1 |
| 4075 | 482 | 2232 | 7234 |
| 1630 | 723 | 496 | 14468 |
| 20375 | 7712 | 7192 | 151914 |

— Find the products. Be sure your decimal point is placed properly.

|  | a | b | c | d |
|---|---|---|---|---|
| **2.** | 68.7<br>×8.9 | 1.7 6<br>×4.8 | 2 1.7<br>×6.9 7 | 3.28 6<br>×21.6 |
| **3.** | 9 43<br>×0.36 | 31.2 2<br>×3.9 | 0.3 7<br>×9.9 | 0.0 25<br>×0.86 |
| **4.** | 15 8.7<br>×0.0 4 | 246.8<br>×0.3 | 32 7.9<br>×0.0 8 | 1 03.6<br>×0.00 9 |
| **5.** | 45 8<br>×4.8 | 7.0 8<br>×7.8 | 8.9684<br>×600 | 11 0.4<br>×0.0 6 |
| **6.** | 17.28<br>×4.5 | 4.52<br>×0.41 | 0.76 4<br>×8.6 | 9.1<br>×3.9 |

# Review of fractional numbers named by decimals

— Rename each of the following numerals, using a fraction or a mixed form in lowest terms.

| | a | b |
|---|---|---|
| **1.** | 5.35 | 4.24 |
| **2.** | 0.65 | 0.48 |
| **3.** | 1.056 | 9.825 |
| **4.** | 0.226 | 0.072 |
| **5.** | 0.98 | 0.36 |
| **6.** | 6.175 | 3.280 |

— Name each of the following, using a decimal.

**7.** nine and sixteen hundredths ____________

**8.** one hundred twenty-two and thirteen thousandths ____________

**9.** two hundred and two tenths ____________

**10.** five hundred twenty-one thousandths ____________

**11.** eight hundredths ____________

**12.** three and seven thousandths ____________

**13.** five hundred fifty and one tenth ____________

**14.** nine hundred nine thousandths ____________

**15.** forty-two hundredths ____________

**16.** seventeen and four thousandths ____________

**17.** fifteen hundredths ____________

**18.** six hundred sixty-six thousand and six thousandths ____________

# Practice

— Solve these number sentences.

**1.** 2.22 + 1.34 + 5.70 + 6.98 = ________

**2.** 243.78 − 18.99 = ________

**3.** 42.40 − 22.56 = ________

**4.** 25.003 + 8.461 + 12.606 = ________

**5.** 124.60 − 4.93 = ________

**6.** 77.080 + 13.956 + 10.244 = ________

| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| | | | | | |

**7.** 22.2 × 0.08 = ________

**8.** 4.6 × 3.4 = ________

**9.** 54.03 × 0.09 = ________

**10.** 0.28 × 30 = ________

**11.** 296 × 0.5 = ________

**12.** 91.87 × 0.4 = ________

| 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|
| | | | | | |

**13.** 0.39 × 0.046 = ________

**14.** 0.011 × 95 = ________

**15.** 0.77 × 300 = ________

**16.** 85.9 × 7.9 = ________

**17.** 1.9 × 2.6 = ________

**18.** 0.36 × 9.3 = ________

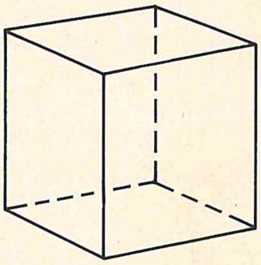
| 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|
| | | | | | |

| | a | b | c |
|---|---|---|---|
| **19.** | 79.3 ÷ _____ = 0.793 | 4.65 ÷ _____ = 0.465 | 25 ÷ _____ = 0.025 |
| **20.** | 375 ÷ _____ = 37.5 | 8.3 ÷ _____ = 0.083 | 0.9 ÷ _____ = 0.0009 |

# Closed surfaces

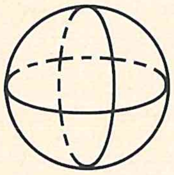
A closed surface separates space into three sets of points: (1) those outside the surface, (2) those inside the surface, and (3) those that form the surface itself.

**1.** The closed surface shown in the drawing below is a special rectangular prism called a **cube.** Each side or flat surface is called a **face.** The intersection of any two faces is a line segment called an **edge.**

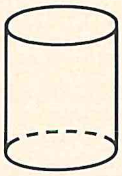


- How many faces does this cube have? _____
- How many edges does it have? _____
- What kind of closed path is formed by the edges of each of its faces? A __________

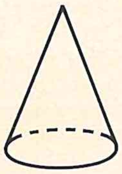
**2.** Name the closed surfaces shown in the drawings below.



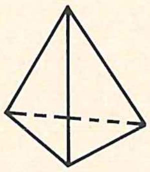
__________



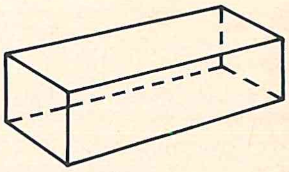
__________



__________



__________



__________

**3.** Name two objects that are shaped like a sphere. __________ __________

**4.** Name two objects that are shaped like a cylinder. __________ __________

**5.** Name two objects that are shaped like a cone. __________ __________

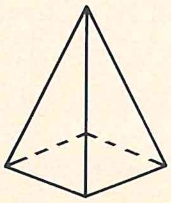
**6.** Which of the closed surfaces above do *not* have:

vertices? ______________________________

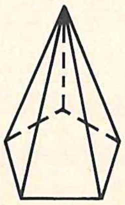
faces? ______________________________

edges? ______________________________

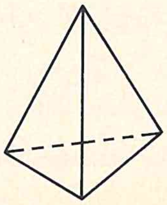
**7.** All the sides of pyramids are triangles that meet at a common vertex. The name of a pyramid is determined by the shape of the base. Name each of the pyramids shown in the drawings below.



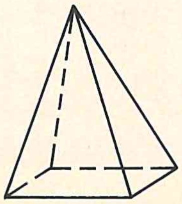
__________ pyramid



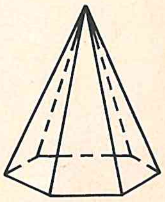
__________ pyramid



__________ pyramid



__________ pyramid

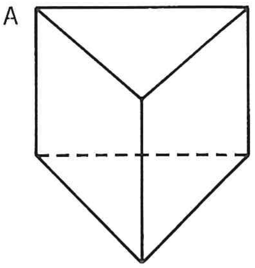


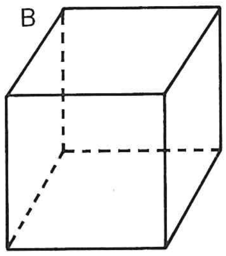
__________ pyramid

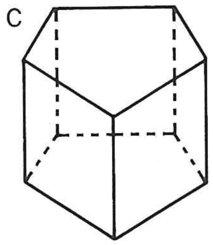
# Prisms

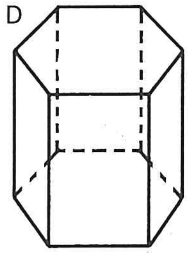
**1.** The closed surfaces represented by the drawings below are called **prisms.**

- Are the bases of each prism parallel to each other? ______
- Do the bases have the same size and shape? ______









**2.** What kind of closed path is formed by the edges of the base of each prism above?

A ______________ B ______________ C ______________ D ______________

**3.** Complete this table about prisms A, B, C, and D. The first row is done.

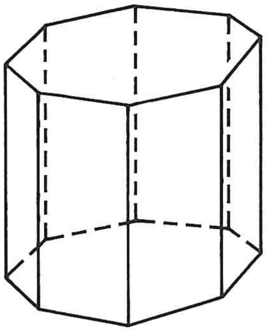
| PRISM | EDGES IN THE BASE | FACES IN THE PRISM | EDGES IN THE PRISM | VERTICES IN THE PRISM |
|---|---|---|---|---|
| A | 3 | 5 | 9 | 6 |
| B | | | | |
| C | | | | |
| D | | | | |

— For each prism, what relationship exists between the number of edges in the base and

**4.** the number of faces in the prism? ______________________________

**5.** the number of edges in the prism? ______________________________

**6.** the number of vertices in the prism? ______________________________



**7.** The drawing at the right represents an octagonal prism.

As its base it has a closed path with ______ edges.

- How many faces does it have? ______
- How many edges does it have? ______
- How many vertices does it have? ______

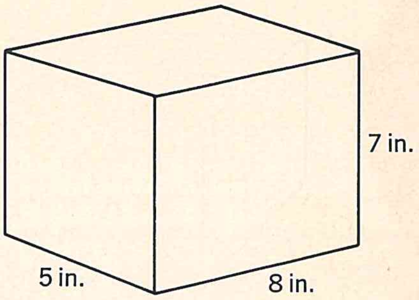
# The volume of a rectangular prism

The union of the set of points of a closed surface and all the points inside the closed surface is called a **solid region.** The measure of a solid region is called the **volume.**

The volume of a solid region whose boundary is a rectangular prism is often called the volume of a rectangular prism.

To find the volume of this rectangular prism, find the product of its length, width, and height. You can use this formula: $V = (l \times w) \times h$

$$(8 \times 5) \times 7 = 40 \times 7 = 280 \text{ cu. in.}$$



— The length, width, and height of rectangular prisms are given below. Find the volume of each prism. The first one is done for you.

| | LENGTH | WIDTH | HEIGHT | VOLUME |
|---|---|---|---|---|
| **1.** | 6 inches | 7 inches | 9 inches | 378 cu. in. |
| **2.** | 10 inches | 8 inches | 11 inches | |
| **3.** | 20 inches | 15 inches | 4 inches | |
| **4.** | 9 inches | 12 inches | 6 inches | |
| **5.** | 7 feet | 9 feet | 14 feet | |
| **6.** | 4 feet | 7 feet | 8 feet | |
| **7.** | 13 feet | 2 feet | 5 feet | |
| **8.** | 4 yards | 6 yards | 8 yards | |
| **9.** | 7 yards | 7 yards | 7 yards | |
| **10.** | 20 yards | 3 yards | 5 yards | |
| **11.** | $2\frac{1}{2}$ inches | 4 inches | 7 inches | |
| **12.** | $3\frac{1}{4}$ inches | 8 inches | 5 inches | |
| **13.** | $\frac{1}{2}$ foot | $\frac{1}{4}$ foot | $\frac{3}{4}$ foot | |
| **14.** | $1\frac{1}{2}$ yards | $\frac{1}{2}$ yard | 6 yards | |
| **15.** | $3\frac{1}{2}$ feet | 8 feet | $1\frac{1}{2}$ feet | |
| **16.** | 12 feet | $\frac{1}{2}$ foot | 4 feet | |
| **17.** | 2 inches | 2 inches | $\frac{7}{8}$ inch | |
| **18.** | $\frac{3}{4}$ inch | $\frac{1}{2}$ inch | $\frac{3}{8}$ inch | |

WORK SPACE

# Finding the volume

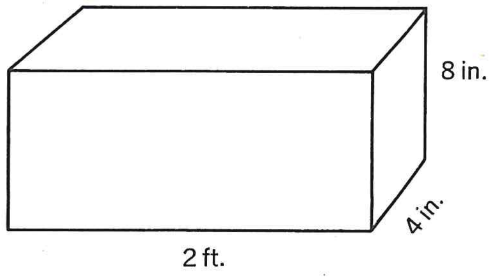
To find the volume of this rectangular prism:

- you could express all dimensions as inches and give your answer in cubic inches.

$$(24 \times 4) \times 8 = 96 \times 8 = 768 \text{ cu. in.}$$

- you could express all dimensions as feet and give your answer in cubic feet.

$$\frac{2}{1} \times \frac{4}{12} \times \frac{8}{12} = \frac{2}{1} \times \frac{1}{3} \times \frac{2}{3} = \frac{4}{9} \text{ cu. ft.}$$



— The length, width, and height of rectangular prisms are given below. Find the volume of each prism in both ways. The first one is done for you.

| | LENGTH | WIDTH | HEIGHT | VOLUME | |
|---|---|---|---|---|---|
| | | | | CU. IN. | CU. FT. |
| **1.** | 1 foot | 6 inches | 5 inches | 360 | $\frac{5}{24}$ |
| **2.** | 8 inches | 4 inches | 1 foot | | |
| **3.** | 3 feet | 2 inches | 3 inches | | |
| **4.** | 10 inches | 8 inches | 1 foot | | |
| **5.** | 6 inches | 3 inches | 2 feet | | |
| **6.** | 2 feet | 1 foot | 3 inches | | |
| **7.** | 1 foot | 9 inches | 1 foot | | |
| **8.** | 11 inches | 2 feet | 7 inches | | |
| **9.** | 4 feet | 8 inches | 2 inches | | |
| **10.** | 2 feet | 3 feet | 1 inch | | |
| **11.** | 5 feet | 6 inches | 4 inches | | |
| **12.** | 10 inches | 6 inches | 2 feet | | |

WORK SPACE

1,728 cubic inches make 1 cubic foot
27 cubic feet make 1 cubic yard

**13.** 2 cu. ft. make ______ cu. in.

**14.** 5 cu. ft. make ______ cu. in.

**15.** 3 cu. yd. make ______ cu. ft.

**16.** 108 cu. ft. make ______ cu. yd.

**17.** 3 cu. ft. make ______ cu. in.

**18.** 5 cu. yd. make ______ cu. ft.

**19.** 3 cu. yd. make ______ cu. ft.

**20.** 54 cu. ft. make ______ cu. yd.

# Problem solving

**1.** Mr. Warren's pool is 20 feet wide, 30 feet long, and 8 feet deep. How many cubic feet of water does it take to fill it to a depth of 7 feet? _____

If he can fill his pool in 70 hours, how many cubic feet of water does he pump in the pool in one hour? _____

**2.** When Mr. Brower put an oil burner in his home, the oil tank was placed in the ground outside his home. The hole for the tank was 7 feet long, 6 feet wide, and 6 feet deep. How many cubic feet of dirt were dug? _____

If several men dug the hole at the rate of 72 cubic feet an hour, how many hours would it take them to dig the hole? _____

**3.** If a classroom is 24 feet wide, 36 feet long, and 10 feet high, how many cubic feet of air could it contain?

_____

**4.** A fish tank is 4 feet long, 2 feet wide, and 3 feet high. How many cubic feet of water will it hold? _____

If a cubic foot of water is about $62\frac{1}{2}$ pounds, how many pounds of water would the tank hold? _____

**5.** A wooden beam is 4 inches by 4 inches and 18 feet long. How many cubic feet of wood is it? _____

If a cubic foot of that wood weighs 26 pounds, how much would the beam weigh? _____

**6.** A tank with a volume of 1 cubic foot will hold $7\frac{1}{2}$ gallons of water. How many gallons of water will it take to fill a tank 2 feet long, 1 foot wide, and $2\frac{1}{2}$ feet deep? _____

**1**

**2**

**3**

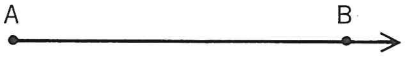
**4**

**5**

**6**

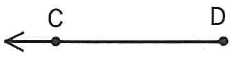
# Rays and angles

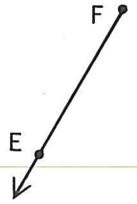
The drawing below represents a **ray.**



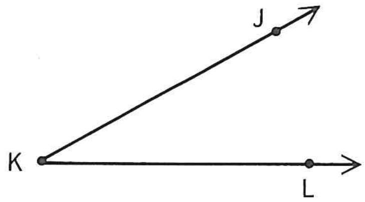
To name a ray first name its endpoint and then name any other point on the ray. The name of ray $AB$ is written $\overrightarrow{AB}$.

**1.** Name each ray below. ______ ______





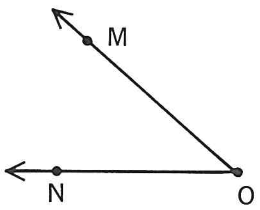
The drawing below represents an **angle.** An angle is the union of two rays with a common vertex.

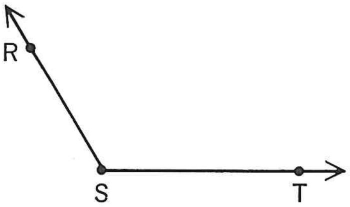


The symbol $\angle$ means angle. The name of the angle above is written $\angle JKL$ or $\angle LKJ$. The letter for the vertex is always written in the middle.

**2.** Give two names for each angle below.

______ ______ ______ ______

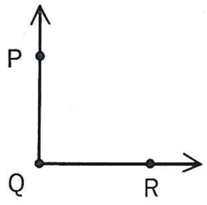




**3.** In the space below, make a drawing of $\overrightarrow{XY}$ and a drawing of $\angle XYZ$.

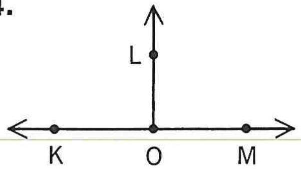
A standard unit of angle measure is the **degree.**

Two rays that have a common endpoint and are perpendicular form a right angle with a measurement of 90°.



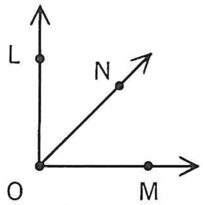
What is the measure of each angle?

**4.**



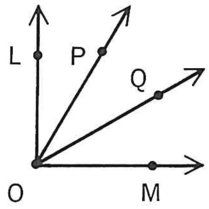
$\angle KOL$ ______ $\angle LOM$ ______

**5.**



$\angle LON$ ______ $\angle NOM$ ______

**6.**

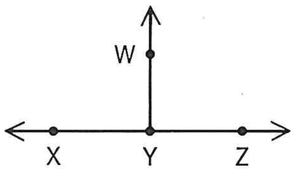


$\angle LOP$ ______ $\angle POQ$ ______

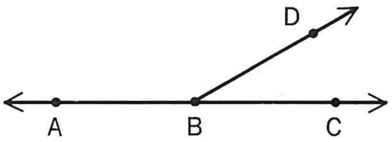
$\angle QOM$ ______

Try these

**7.** If $\angle XYW$ and $\angle WYZ$ are right angles, what is the sum of their measures? ______



**8.** If $ABC$ is a straight line, what is the sum of the measures of $\angle ABD$ and $\angle DBC$? ______

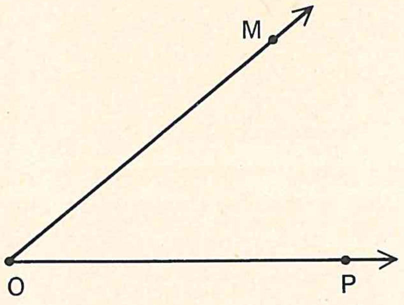


# Measuring angles

You use a ruler as an instrument to measure line segments.
To measure an angle you use an instrument called a **protractor.**

— Give two names for each angle shown below. Then use a protractor to measure each angle. The first one is done for you.

**1.**

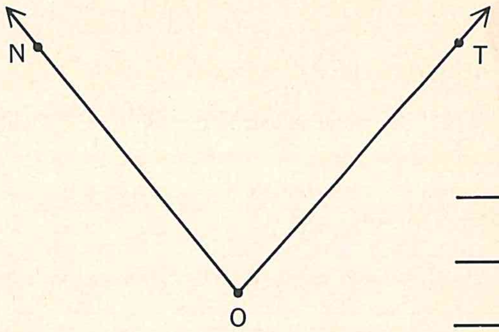


∠*MOP*

∠*POM*

40°

**2.**

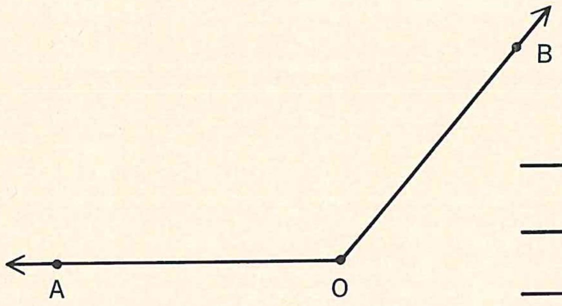


______

______

______

**3.**

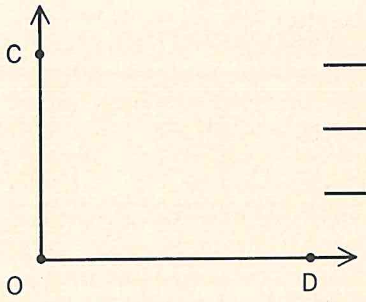


______

______

______

**4.**

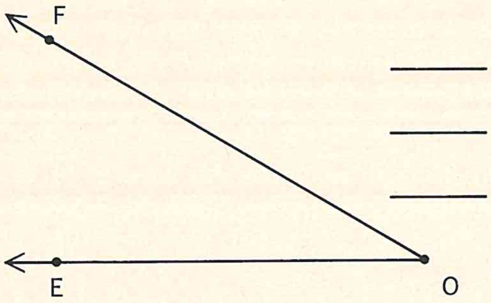


______

______

______

**5.**

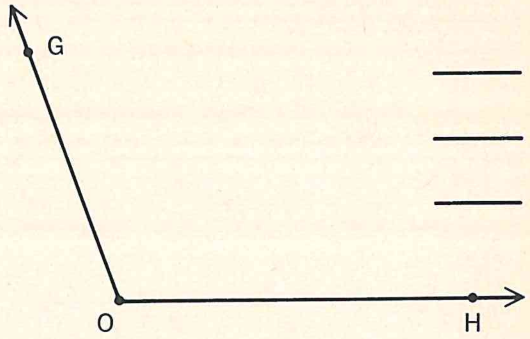


______

______

______

**6.**

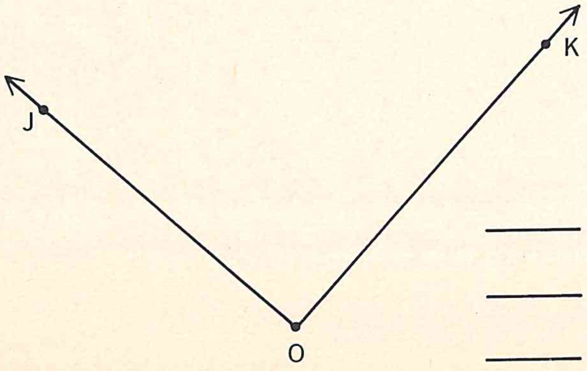


______

______

______

**7.**

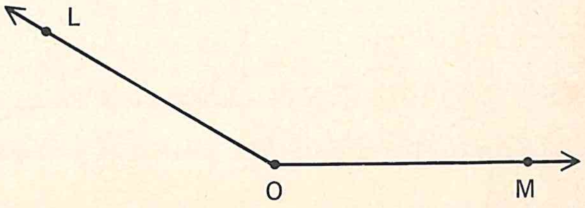


______

______

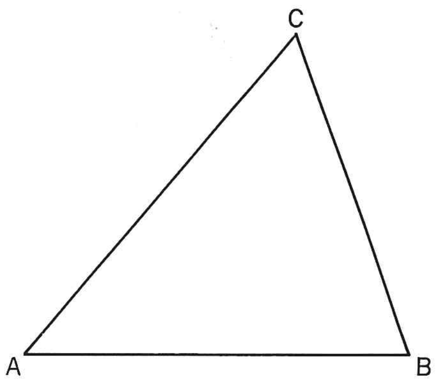
______

**8.**



______ ______ ______

# Measuring angles



**1.** The upper angle in triangle $ABC$ is named $\angle ACB$ or $\angle BCA$. Name each of the other angles in two ways.

_____ or _____

_____ or _____

**2.** How many degrees are in each angle of the triangle?

_____, _____, _____

**3.** What is the sum of the measures of the three angles? _____

**4.** Draw any three triangles. Label them as shown.

Triangle $DEF$ Triangle $JKL$ Triangle $MNO$

**5.** Measure the angles in each triangle to the nearest degree.

Triangle $DEF$: _____ _____ _____

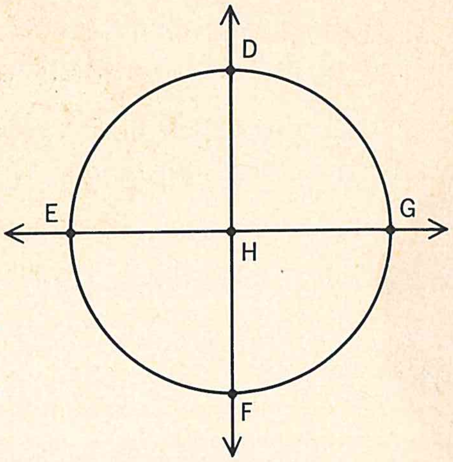
Triangle $JKL$: _____ _____ _____

Triangle $MNO$: _____ _____ _____

**6.** What is the sum of the measures of the three angles in each triangle?

Triangle $DEF$ _____ Triangle $JKL$ _____ Triangle $MNO$ _____

# Arc-degrees



**1.** The drawing at the right shows two perpendicular lines that separate the circle into four arcs of the same size.

Name them. _____ _____

**2.** One of the arcs is arc $ED$. Name the other three arcs.

_____ _____ _____

**3.** You know that every circle measures 360 arc-degrees.

Each arc named above has a measure of _____ arc-degrees.

Then each arc is $\frac{90}{360}$ or _____ of the whole circle.

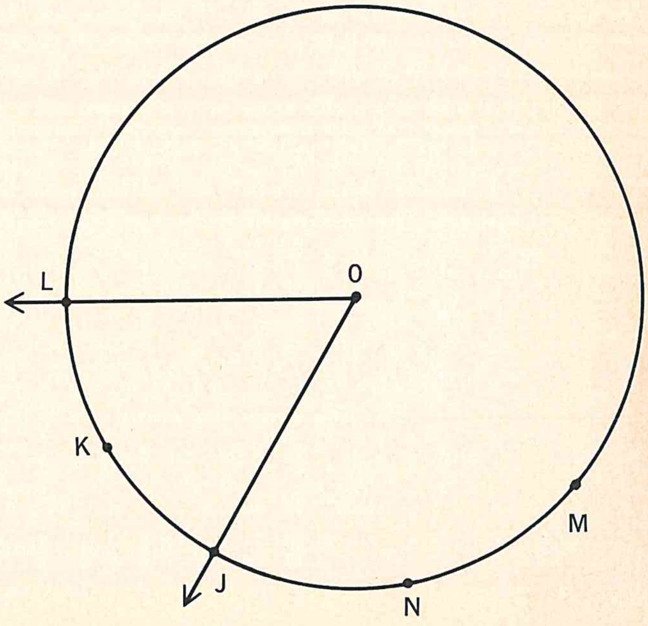
**4.** What is the measure of arc $EDG$? _____ arc $EFG$? _____ arc $DEF$? _____

arc $DGF$? _____ Then each arc is $\frac{180}{360}$ or _____ of the whole circle.

**5.** What part of a circle is an arc that measures

| **a** | **b** | **c** |
|---|---|---|
| 120°? _____ | 72°? _____ | 40°? _____ |
| 60°? _____ | 36°? _____ | 10°? _____ |
| 20°? _____ | 30°? _____ | 1°? _____ |

WORK SPACE



**6.** The drawing at the right shows two rays that intersect the circle at points $J$ and $L$.

Name them. _____ _____

**7.** The two rays form an angle with the center of the circle as its vertex. Name the angle in two ways. _____ _____

**8.** Angle measure can be used to find what part arc $JKL$ is of the circle. Measure $\angle LOJ$ with a protractor. Arc $JKL$ measures _____ arc-degrees. It is _____ of the circle.

**9.** Draw $\overrightarrow{OM}$ in the circle. What is the measure of arc $JNM$? _____ What part of the circle is it? _____

# Graphing number pairs

You can make a sentence by graphing number pairs. Follow the directions below. On the graph on page 115, locate the number pairs in the order they are given.

**1.** Locate the point for (10W, 10N). Then locate the point for (9W, 14N). Use a ruler and draw a line segment from the dot at (10W, 10N) to the dot at (9W, 14N).

**2.** Locate the point for (8W, 12N). Then draw a line segment from the dot at (9W, 14N) to the dot at (8W, 12N).

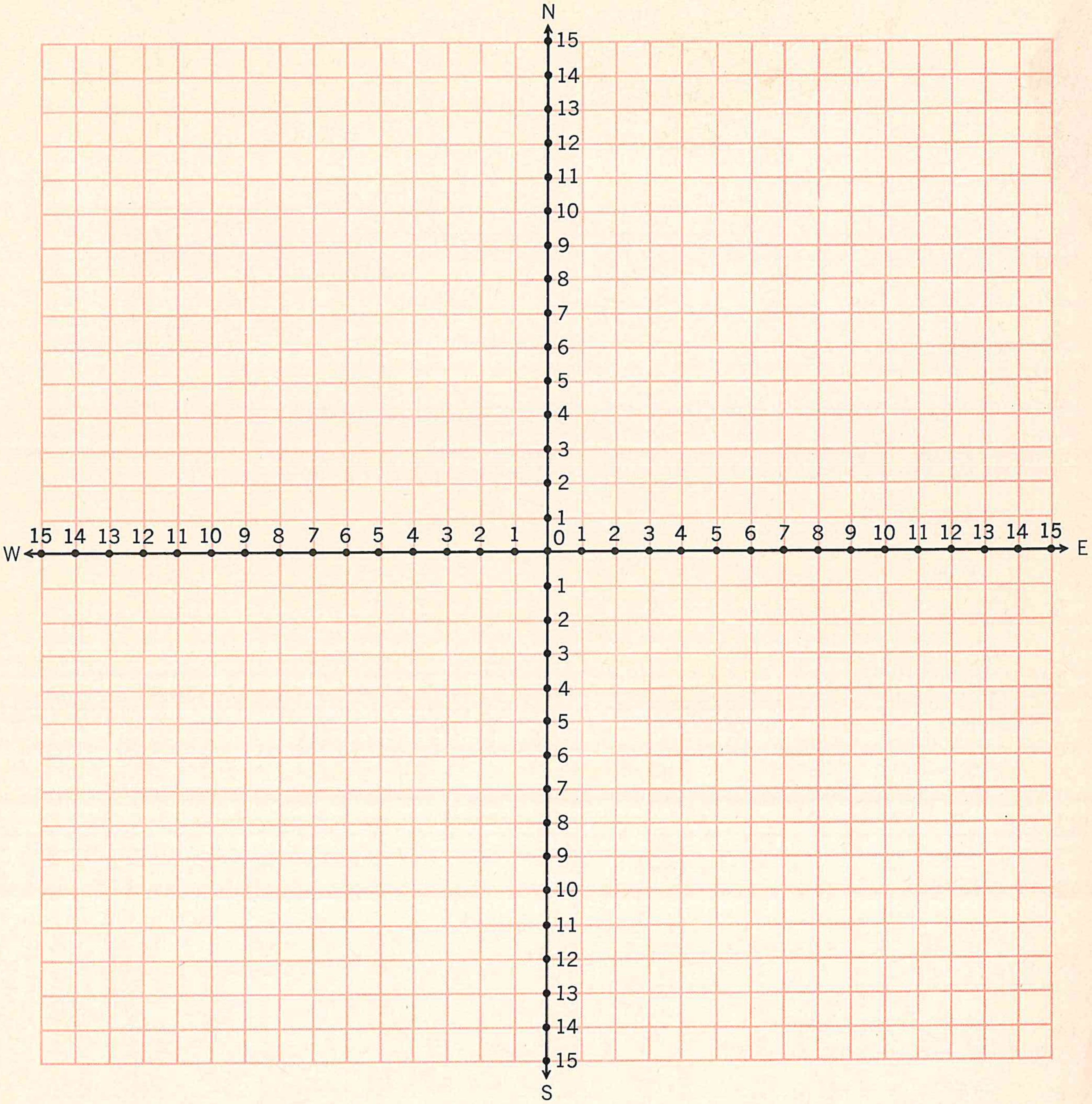
**3.** Locate the point for (7W, 14N). Then draw a line segment from the dot at (8W, 12N) to the dot at (7W, 14N).

— Continue locating the following number pairs, drawing line segments from dot to dot.

**4.** (7W, 14N) and (6W, 10N)
**5.** (5W, 10N) and (3W, 14N)
**6.** (3W, 14N) and (1W, 10N)
**7.** (4W, 12N) and (2W, 12N)
**8.** (0W, 14N) and (4E, 14N)
**9.** (2E, 14N) and (2E, 10N)
**10.** (5E, 14N) and (5E, 10N)
**11.** (8E, 14N) and (8E, 10N)
**12.** (5E, 12N) and (8E, 12N)
**13.** (1W, 5N) and (1W, 1N)
**14.** (1E, 1N) and (3E, 1N)
**15.** (3E, 1N) and (4E, 2N)
**16.** (4E, 2N) and (1E, 4N)
**17.** (1E, 4N) and (2E, 5N)
**18.** (2E, 5N) and (4E, 5N)
**19.** (2W, 3S) and (5W, 3S)
**20.** (5W, 3S) and (5W, 7S)
**21.** (5W, 5S) and (3W, 5S)
**22.** (1W, 3S) and (1W, 6S)
**23.** (1W, 6S) and (0W, 7S)
**24.** (0W, 7S) and (1E, 7S)
**25.** (1E, 7S) and (2E, 6S)
**26.** (2E, 6S) and (2E, 3S)
**27.** (3E, 7S) and (3E, 3S)
**28.** (3E, 3S) and (6E, 7S)
**29.** (6E, 7S) and (6E, 3S)

**30.** What is the sentence? ______________________

# Graphing number pairs



# Review

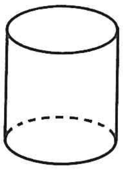
— Choose a word from this list to complete each exercise below. Then write the word in the blank.

| | | | | | | |
|---|---|---|---|---|---|---|
| **perpendicular** | **volume** | **union** | **cylinder** | **face** | **angle** | **ray** |
| **protractor** | **vertex** | **degree** | **pyramid** | **prism** | **cone** | **right** |

1. The instrument used for measuring angles is called a ____________.
2. The standard unit of angle measure is called the ____________.
3. The measure of a solid region is called the ____________ of the region.
4. An angle is the ____________ of two rays with a common endpoint. The common endpoint is called the ____________ of the angle.
5. A 90° angle is called a ____________ angle.
6. If two rays form a 90° angle, the rays are ____________ to each other.
7. Each side, or flat surface, of a prism is called a ____________.

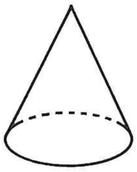
— Give the name of what each drawing below represents.

8.



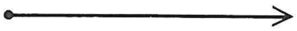
____________

9.



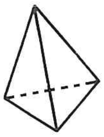
____________

10.



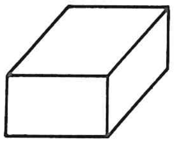
____________

11.



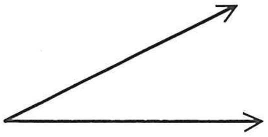
____________

12.



____________

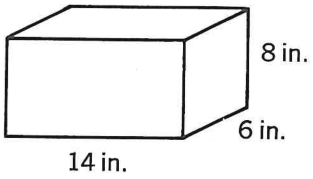
13.



____________

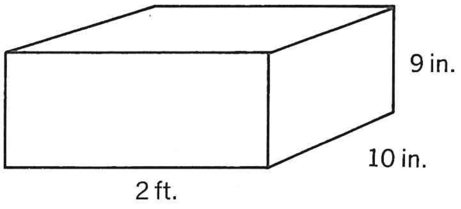
— Find the volume of each solid region shown below.

14.



____________

15.



____________

| 14 | 15 |
|---|---|
| | |

# Problem Test 5

**1.** Joe ran the school track in 20.9 seconds. Ken ran the track in 24.2 seconds. Which boy was faster? ______ How much faster? __________

**2.** In one week, Chesterdale had 0.87 inches of rain on Monday, 0.45 inches on Wednesday, and 1.04 inches on Friday. What was the total rainfall for the week? __________

**3.** A bowling alley is usually 3.5 feet wide and 60 feet long. What is its area? __________

**4.** Traveling at an average rate of 37.4 miles an hour, how many miles will a car travel in 6.5 hours? __________

**5.** Bruce's father has a storage bin for grain. The bin measures 20 feet by 15 feet by $8\frac{1}{2}$ feet. How many cubic feet of grain will it hold? __________

**6.** Lillian needs $1\frac{3}{4}$ yards of yellow net and $2\frac{7}{8}$ yards of white net to make a ballet skirt for dancing class. How much will the net cost if it is 80¢ a yard? __________

**7.** A food freezer measures 2 feet by $2\frac{1}{2}$ feet by 4 feet. It sells for $269.80, a cost of __________ per cubic foot.

**8.** At an average rate of 315.8 miles an hour, how many miles can a plane fly in 4.5 hours? __________

**9.** Mr. Harrison's basement is 30 feet long, 20 feet wide, and 10 feet high. If he wants to paint the floor and the walls, how many square feet must he paint? __________

**10.** Ellen has 7 yards of material. Her dress pattern calls for $2\frac{1}{3}$ yards. How many dresses can she make? ______

Number correct: ______. Date: ____________ ____, ________
Write your score on the Problem Test Record on page 160. Fill in the fifth bar in the Problem Test Graph on page 160.

| | |
|---|---|
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |
| 7 | 8 |
| 9 | 10 |

# Review

**1.**

$$\begin{array}{r} 4.6\\ 2.8\\ 7.9\\ 5.6\\ +4.3\\ \hline \end{array} \qquad \begin{array}{r} 7.75\\ 0.27\\ 6.35\\ 0.78\\ +6.39\\ \hline \end{array} \qquad \begin{array}{r} 0.769\\ 0.075\\ 9.208\\ 2.750\\ +0.035\\ \hline \end{array}$$

**2.**

$$\begin{array}{r} 5.84\\ -2.87\\ \hline \end{array} \qquad \begin{array}{r} 8.07\\ -0.49\\ \hline \end{array} \qquad \begin{array}{r} 7.003\\ -0.384\\ \hline \end{array}$$

**3.** $432\overline{)8{,}643}$ $\qquad$ $42\overline{)28{,}476}$

**4.** $4\frac{3}{4} \times \frac{4}{7} =$

**5.**

$$\begin{array}{r} 2\frac{1}{3}\\ +2\frac{3}{4}\\ \hline \end{array} \qquad \begin{array}{r} 9\frac{1}{5}\\ -3\frac{1}{3}\\ \hline \end{array}$$

**6.**

$$\begin{array}{r} 399\\ \times 30.5\\ \hline \end{array} \qquad \begin{array}{r} 476\\ \times 0.98\\ \hline \end{array} \qquad \begin{array}{r} 29.7\\ \times 0.38\\ \hline \end{array}$$

# Progress Test 5

**1.** $100 \times 6.759 =$ ______

**2.** $32.5 \times 1{,}000 =$ ______

**3.** $\frac{3}{5} \div 2\frac{1}{10} =$

**4.** $5\frac{1}{2} \div 1\frac{1}{4} =$

**5.** $4\frac{3}{4} \times 12 =$

**6.** $3\frac{1}{3} \times 1\frac{1}{5} =$

**7.** What is the cost of 265 gallons of fuel oil at $0.186 a gallon? ______

**8.** What is the perimeter of a lot 60 feet by 180 feet? ______

**9.** The area of a ping-pong table 9 feet by 60 inches is ____ square feet.

**10.** The volume of a storage box 4 feet long, 2 feet wide, and 18 inches deep is ____ cubic feet.

WORK SPACE

Number correct: ____. Date: ________ ____, ______.
Write your score on the Progress Test Record on page 160. Fill in the fifth bar in the Progress Test Graph on page 160.

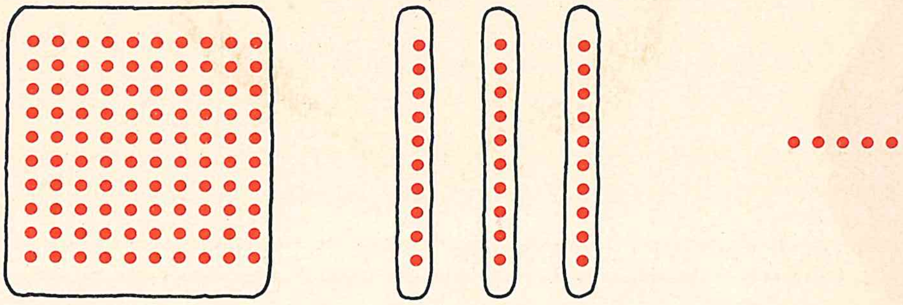
# Base ten and place value

You know that our system for naming numbers is called a decimal system. It is based on grouping by ten. You can say that it is a base-ten system.

You also know that the value of a digit depends on its place in a numeral.

**1.** Name the number of dots shown at the right.

**2.** Write the decimal numeral that is another name for 1 hundred 3 tens 5 ones. _____



_____ hundred _____ tens _____ ones

In the following expressions, 135 is renamed using expanded notation.

**a.** $(1 \times 100) + (3 \times 10) + 5$ **b.** $(1 \times 10 \times 10) + (3 \times 10) + 5$

— Complete the following sentences to make them true.

| | a | b |
|---|---|---|
| **3.** | $852 = (8 \times 100) + (\_\_\_\_ \times 10) + 2$ | $852 = (8 \times 10 \times 10) + (\_\_\_\_ \times 10) + 2$ |
| **4.** | $679 = (6 \times 100) + (\_\_\_\_ \times 10) + 9$ | $679 = (6 \times 10 \times 10) + (\_\_\_\_ \times 10) + 9$ |
| **5.** | $902 = (\_\_\_\_ \times 100) + 2$ | $902 = (\_\_\_\_ \times 10 \times 10) + 2$ |
| **6.** | $740 = (\_\_\_\_ \times 100) + (4 \times 10)$ | $740 = (\_\_\_\_ \times 10 \times 10) + (\_\_\_\_ \times 10)$ |

— Rename, using expanded notation in two ways as shown above.

**7.** 871 = ____________________ ____________________

**8.** 462 = ____________________ ____________________

**9.** 703 = ____________________ ____________________

**10.** 690 = ____________________ ____________________

**11.** In the numeral 598, how much greater or less is the new number if

- 5 is changed to 9? __________
- 9 is changed to 3? __________
- 9 and 8 are interchanged? __________
- 5 and 9 are interchanged? __________

**12.** In the numeral 749, how much greater or less is the new number if

- 9 is changed to 0? __________
- 7 is changed to 9? __________
- 4 and 9 are interchanged? __________
- 4 and 7 are interchanged? __________

# Base six and place value

**1.** How many digits are there in our base-ten system? _____

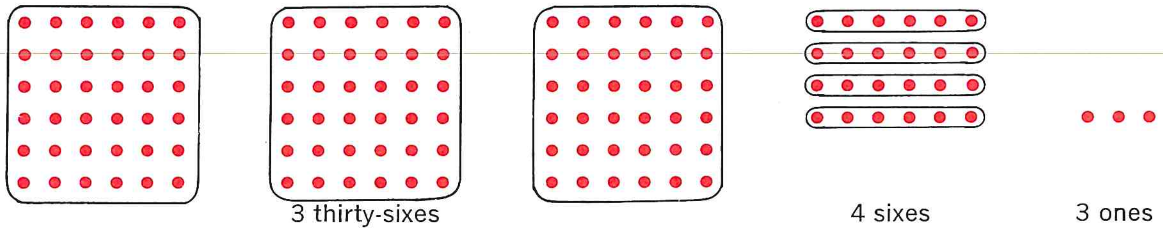
**2.** How many digits, then, would be in a base-six system? _____ Name them.

_____ _____ _____ _____ _____ _____

**3.** What is the greatest number you can name with one digit in base six? _____

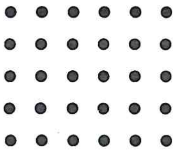
**4.** Each place in a base-six numeral has a value _____ times the value of the place at its right.

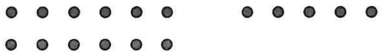
**5.** If a base-six numeral has three places, what is the value of the place at the far right? _____ the next place to the left? _____ What is the value of the place at the far left? _____

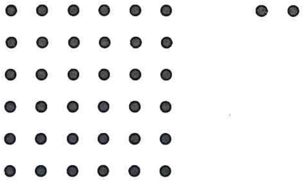


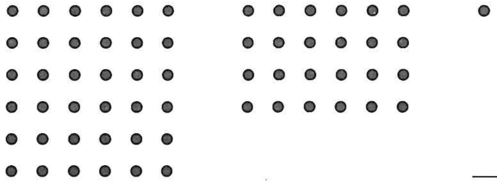
The base-six numeral that stands for 3 thirty-sixes 4 sixes 3 ones is written 343$_{six}$ and is read "three-four-three, base six."

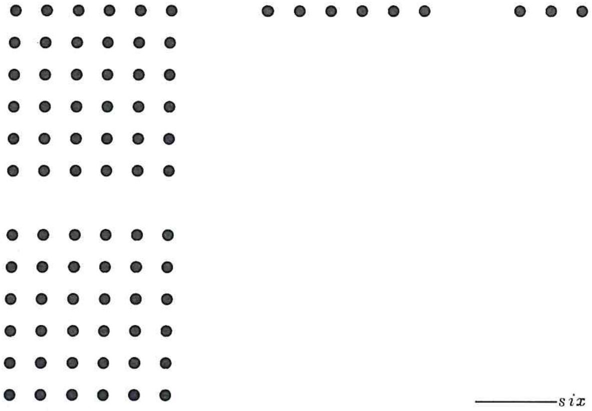
— What base-six numeral names the number of dots in each exercise below?

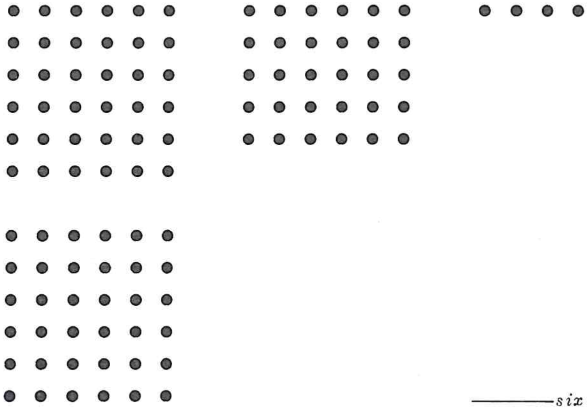
**6.**

_____$_{six}$

**9.**

_____$_{six}$

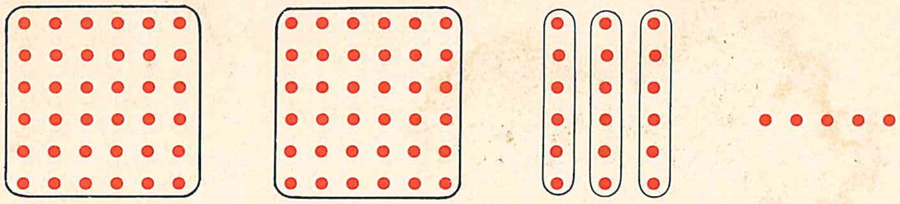
**7.**

_____$_{six}$

**10.**

_____$_{six}$

**8.**

_____$_{six}$

**11.**

_____$_{six}$

# Base six expanded notation



**1.** What base-six numeral names the number of dots above?

_____ thirty-sixes _____ sixes _____ ones, or $\_\_\_\_\__{six}$

**2.** To find the base-ten numeral that names the same number as $235_{six}$, rename $235_{six}$ using expanded notation.

$$235_{six} = (2 \times 36) + (3 \times 6) + 5$$

$$= \quad 72 \quad + \quad 18 \quad + 5, \text{ or } \_\_\_\_\_$$

Do $235_{six}$ and 95 name the same number? _____

— Write the base-ten numeral for each number named below. The first one is done for you.

WORK SPACE

**3.** $132_{six} = (1 \times 36) + (3 \times 6) + 2 = 36 + 18 + 2 = 56$

**4.** $153_{six} =$ ____________________

**5.** $142_{six} =$ ____________________

**6.** $222_{six} =$ ____________________

**7.** $303_{six} =$ ____________________

**8.** $234_{six} =$ ____________________

**9.** $410_{six} =$ ____________________

**10.** $543_{six} =$ ____________________

**11.** $251_{six} =$ ____________________

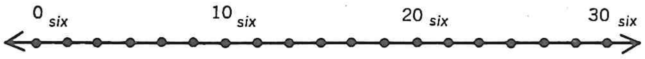
**12.** $520_{six} =$ ____________________

**13.** $404_{six} =$ ____________________

**14.** $23_{six} =$ ____________________

# Addition and subtraction in base six

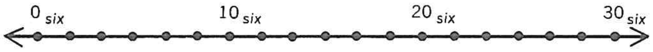
Here is a base-six number line. To find the sum of $3_{six}$ and $4_{six}$, start at zero and draw an arrow to the point for 3 on the line. Then draw another arrow four more spaces to the right.



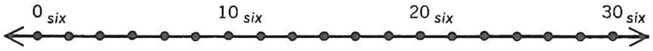
**1.** What base-six numeral makes this sentence true? $3_{six} + 4_{six} = \underline{\qquad}_{six}$

Draw arrows on the number lines to help you complete the number sentences.

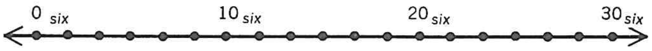
**2.** $5_{six} + 3_{six} = \underline{\qquad}_{six}$



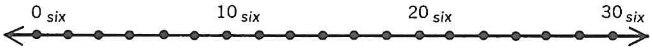
**3.** $3_{six} + 3_{six} = \underline{\qquad}_{six}$



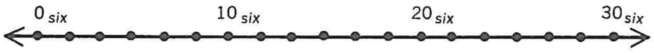
**4.** $13_{six} + 3_{six} = \underline{\qquad}_{six}$



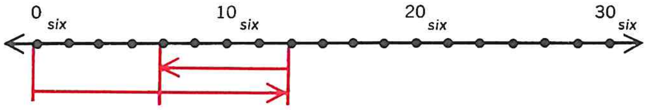
**5.** $5_{six} + 4_{six} = \underline{\qquad}_{six}$



**6.** $10_{six} + 5_{six} = \underline{\qquad}_{six}$



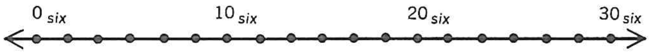
Here is a base-six number line. To subtract $4_{six}$ from $12_{six}$, start at zero and draw an arrow to the point for 12 on the number line. Then draw another arrow four spaces to the left.



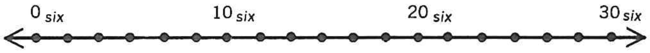
**1.** What base-six numeral makes this sentence true? $12_{six} - 4_{six} = \underline{\qquad}_{six}$

Draw arrows on the number lines to help you complete the number sentences.

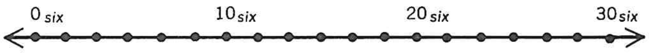
**2.** $10_{six} - 4_{six} = \underline{\qquad}_{six}$



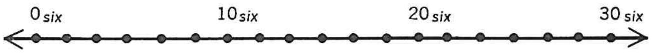
**3.** $11_{six} - 3_{six} = \underline{\qquad}_{six}$



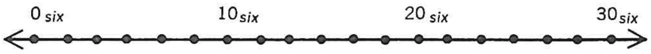
**4.** $12_{six} - 5_{six} = \underline{\qquad}_{six}$



**5.** $13_{six} - 4_{six} = \underline{\qquad}_{six}$



**6.** $15_{six} - 3_{six} = \underline{\qquad}_{six}$



# More addition in base six

You know that in base-ten renaming is necessary when the sum in a column is greater than 9. Similarly, in base-six renaming is necessary when the sum in a column is greater than 5.

**1.** Study these addition examples.

| | |
|---|---|
| 24 = 2 tens 4 ones | $34_{six}$ = 3 sixes 4 ones |
| + 18 = 1 ten 8 ones | + $14_{six}$ = 1 six 4 ones |
| 3 tens 12 ones | 4 sixes 12 ones |
| or 4 tens 2 ones | or 5 sixes 2 ones |

In the base-six example above, does the numeral 12 name 1 set of six and 2 left over? ____ 4 sixes + 1 six = ____ sixes

Then another name for 4 sixes 12 ones is ____ sixes ____ ones.

What base-six numeral is the sum of $34_{six}$ and $14_{six}$? $\_\_\_\__{six}$

**2.** To find the sum of $43_{six}$ and $45_{six}$, complete the example in the box.

▶ Add the ones. $3_{six} + 5_{six}$ = ____ Write the 2 in the ones place.

▶ Add the sixes. $(1_{six} + 4_{six}) + 4_{six}$ = ____ Where will you write 13?

What is the sum of $43_{six}$ and $45_{six}$? $\_\_\_\__{six}$

In the answer, the 2 stands for 2 ones. What does the 3 stand for?

____ the 1? ____

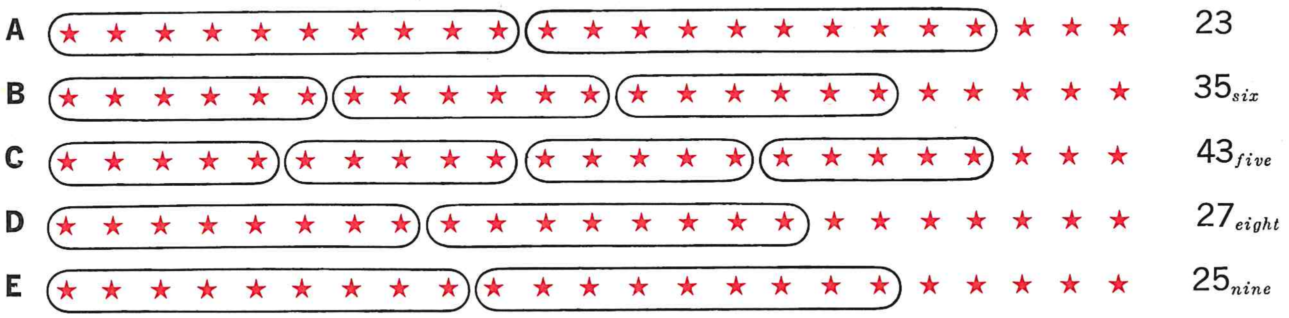
$$\boxed{\begin{array}{r} 43_{six} \\ +45_{six} \\ \hline \\ \end{array}}$$

— Find the base-six numeral for each sum.

| | a | b | c | d |
|---|---|---|---|---|
| **3.** | $\begin{array}{r} 34_{six} \\ +13_{six} \\ \hline \end{array}$ | $\begin{array}{r} 42_{six} \\ +52_{six} \\ \hline \end{array}$ | $\begin{array}{r} 44_{six} \\ +15_{six} \\ \hline \end{array}$ | $\begin{array}{r} 52_{six} \\ +24_{six} \\ \hline \end{array}$ |
| **4.** | $\begin{array}{r} 45_{six} \\ +30_{six} \\ \hline \end{array}$ | $\begin{array}{r} 43_{six} \\ +45_{six} \\ \hline \end{array}$ | $\begin{array}{r} 31_{six} \\ +25_{six} \\ \hline \end{array}$ | $\begin{array}{r} 53_{six} \\ +55_{six} \\ \hline \end{array}$ |
| **5.** | $\begin{array}{r} 42_{six} \\ +22_{six} \\ \hline \end{array}$ | $\begin{array}{r} 24_{six} \\ +41_{six} \\ \hline \end{array}$ | $\begin{array}{r} 25_{six} \\ +33_{six} \\ \hline \end{array}$ | $\begin{array}{r} 34_{six} \\ +25_{six} \\ \hline \end{array}$ |

# Other bases

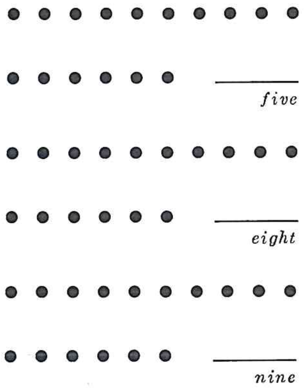
Numbers can be named in bases other than six or ten. In sets A to E below, the stars are grouped by tens, sixes, fives, eights, and nines. Read the base numeral at the right of each set.



**1.** Do sets A to E have the same number of stars? ______ How many are in each set? ______ Do all the numerals name the same number? ______

— In the exercises below, draw closed paths to show sets of five, eight, and nine. Then write the base numeral for the number of dots.

**2.**

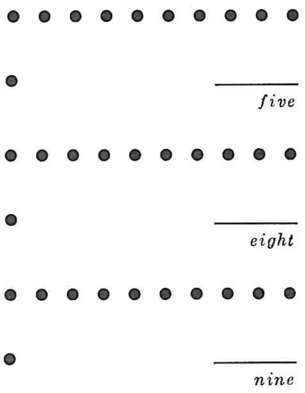


______ *five*

______ *eight*

______ *nine*

**3.**

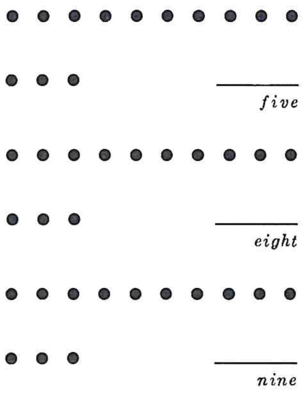


______ *five*

______ *eight*

______ *nine*

**4.**

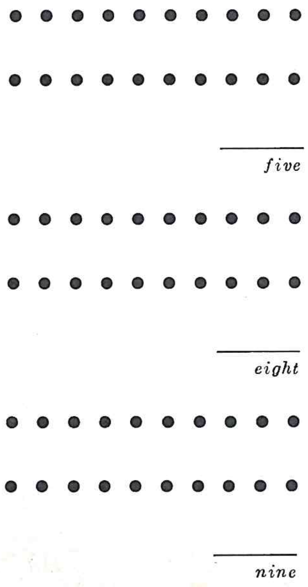


______ *five*

______ *eight*

______ *nine*

**5.**

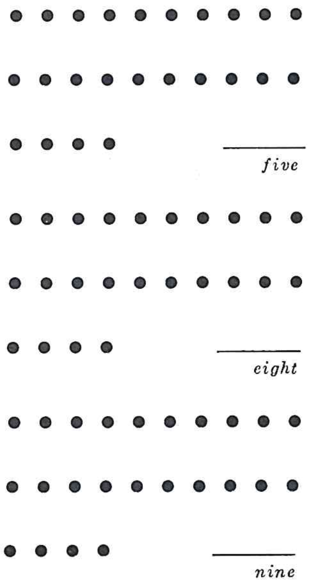


______ *five*

______ *eight*

______ *nine*

**6.**

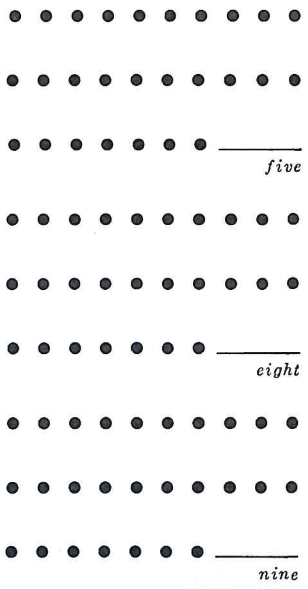


______ *five*

______ *eight*

______ *nine*

**7.**



______ *five*

______ *eight*

______ *nine*

# Expanded notation in other bases

You can find the base-ten, or decimal, numeral that names the same number as $312_{six}$ by using expanded notation.

$$\begin{aligned} 312_{six} &= (3 \times 36) + (1 \times 6) + (2 \times 1) \\ &= 108 + 6 + 2 \\ &= 116 \end{aligned}$$

The expanded notations at the right show how to find the decimal numerals that name the same numbers as $312_{five}$, $312_{eight}$, and $312_{nine}$.

$$\begin{aligned} 312_{five} &= (3 \times 25) + (1 \times 5) + (2 \times 1) \\ &= 75 + 5 + 2 \\ &= 82 \end{aligned}$$

$$\begin{aligned} 312_{eight} &= (3 \times 64) + (1 \times 8) + (2 \times 1) \\ &= 192 + 8 + 2 \\ &= 202 \end{aligned}$$

$$\begin{aligned} 312_{nine} &= (3 \times 81) + (1 \times 9) + (2 \times 1) \\ &= 243 + 9 + 2 \\ &= 254 \end{aligned}$$

— Find the decimal numeral for each number named below.

**1.** $24_{five}$ = ______

**2.** $32_{eight}$ = ______

**3.** $56_{nine}$ = ______

**4.** $143_{five}$ = ______

**5.** $256_{eight}$ = ______

**6.** $375_{nine}$ = ______

**7.** $222_{five}$ = ______

**8.** $337_{eight}$ = ______

**9.** $455_{nine}$ = ______

**10.** $342_{five}$ = ______

**11.** $425_{eight}$ = ______

**12.** $516_{nine}$ = ______

WORK SPACE

# Exponents

In this number sentence, $6 \times 6 \times 6 = 6^3$, the small numeral 3 in $6^3$ is called an **exponent.** It tells the number of times 6 is used as a factor.

Look at the sentences in the box at the right. Then complete Ex. 1 to 6.

**a.** $9 \times 9 = 9^2$
**b.** $4 \times 4 \times 4 = 4^3$
**c.** $5 \times 5 \times 5 \times 5 = 5^4$
**d.** $10 \times 10 \times 10 \times 10 \times 10 = 10^5$
**e.** $3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

**1.** In **a**, 9 is used as a factor _____ times. What is the exponent of 9? _____
You may read $9^2$ as "9 to the second power" or as "9 squared."

**2.** In **b**, 4 is used as a factor _____ times. The exponent of 4 is _____.
You may read $4^3$ as "4 to the third power" or as "4 cubed."

**3.** In **c**, 5 is used as a factor _____ times. The exponent of 5 is _____.
You may read $5^4$ as "5 to the fourth power."

**4.** What is the exponent in sentence **d**? _____ in sentence **e**? _____

**5.** In sentence **d**, how do you read $10^5$? _______ to the _______ power

**6.** In sentence **e**, how do you read $3^6$? _______ to the _______ power

— Rename using exponents. The first one is done for you.

| | a | | b | |
|---|---|---|---|---|
| **7.** | $2 \times 2 \times 2 \times 2 \times 2 \times 2$ | $2^6$ | $1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1$ | _____ |
| **8.** | $4 \times 4 \times 4 \times 4$ | _____ | 3 cubed | _____ |
| **9.** | 25 cubed | _____ | $7 \times 7 \times 7 \times 7$ | _____ |
| **10.** | $18 \times 18 \times 18 \times 18 \times 18 \times 18$ | _____ | $120 \times 120 \times 120 \times 120 \times 120$ | _____ |
| **11.** | $55 \times 55 \times 55 \times 55 \times 55$ | _____ | $99 \times 99 \times 99 \times 99 \times 99 \times 99$ | _____ |
| **12.** | 111 squared | _____ | 100 squared | _____ |

— Rename as the product of like factors. The first one is done for you.

| | | | | |
|---|---|---|---|---|
| **13.** | $2^7$ | $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$ | $1^9$ | _____ |
| **14.** | $7^2$ | _____ | $10^5$ | _____ |
| **15.** | $66^4$ | _____ | $9^8$ | _____ |
| **16.** | $15^3$ | _____ | $27^4$ | _____ |

# Expanded notation and exponents

Here are three ways to name 427 using expanded notation. Read each sentence.

**a.** $427 = 400 + 20 + 7$
**b.** $427 = (4 \times 100) + (2 \times 10) + 7$
**c.** $427 = (4 \times 10 \times 10) + (2 \times 10) + 7$

**1.** In the expression $(4 \times 10 \times 10)$ in sentence **c**, how many times is 10 used as a factor? ______ Then, is this sentence true?

______

**d.** $427 = (4 \times 10^2) + (2 \times 10) + 7$

— Rename each of the following using expanded notation and an exponent as in sentence **d** above.

**2.** 360 = ____________________

**3.** 408 = ____________________

**4.** 572 = ____________________

**5.** 639 = ____________________

**6.** Study the exponents of 10. What do you find when you compare the number of 0's in each numeral with the exponent of 10 for the same number?

$100 = 10^2$
$1,000 = 10^3$
$10,000 = 10^4$
$100,000 = 10^5$
$1,000,000 = 10^6$
$10,000,000 = 10^7$

____________________

— Complete each of the following.

**7.** $500 = (\underline{\qquad} \times 10^2)$

**8.** $920 = (\underline{\qquad} \times 10^2) + (\underline{\qquad} \times 10)$

**9.** $3,000 = (\underline{\qquad} \times 10^3)$

**10.** $70,000 = (\underline{\qquad} \times 10^4)$

**11.** $5,400 = (\underline{\qquad} \times 10^3) + (\underline{\qquad} \times 10^2)$

**12.** $8,500 = (\underline{\qquad} \times 10^3) + (\underline{\qquad} \times 10^2)$

**13.** $6,000,000 = (\underline{\qquad} \times 10^6)$

**14.** $80,000,000 = (\underline{\qquad} \times 10^7)$

— Show the exponents of 10.

**15.** $470 = (4 \times 10\text{—}) + (7 \times 10)$

**16.** $7,300 = (7 \times 10\text{—}) + (3 \times 10\text{—})$

**17.** $94,000 = (9 \times 10\text{—}) + (4 \times 10\text{—})$

**18.** $900,506 = (9 \times 10\text{—}) + (5 \times 10\text{—}) + 6$

**19.** $504,000 = (5 \times 10\text{—}) + (4 \times 10\text{—})$

**20.** $8,070 = (8 \times 10\text{—}) + (7 \times 10)$

**21.** What numbers are named below?

$(4 \times 10^3) + (5 \times 10^2) + (8 \times 10)$ ________

$(9 \times 10^4) + (7 \times 10^3) + (6 \times 10^2)$ ________

$(6 \times 10^5) + (8 \times 10^2) + (3 \times 10)$ ________

$(8 \times 10^6) + (6 \times 10^3) + (4 \times 10^2)$ ________

— Rename each number shown below using expanded notation and exponents.

**22.** 63,926 ______________________________

**23.** 578,234 ______________________________

**24.** 953,627 ______________________________

**25.** 8,305,200 ______________________________

**26.** 6,389,094 ______________________________

# Expanded notation and exponents in other bases

Shown at the right are three ways to name $235_{six}$ using expanded notation.

In sentence **c** the exponent shows how many times 6 is used as a factor.

**a.** $235_{six} = (2 \times 36) + (3 \times 6) + 5$
**b.** $235_{six} = (2 \times 6 \times 6) + (3 \times 6) + 5$
**c.** $235_{six} = (2 \times 6^2) + (3 \times 6) + 5$

— Complete these sentences to make them true.

| | a | b |
|---|---|---|
| **1.** | $432_{five} = (4 \times 5^{\_}) + (3 \times \_\_\_) + 2$ | $233_{five} = (2 \times 5^{\_}) + (3 \times \_\_\_) + \_\_\_$ |
| **2.** | $541_{six} = (5 \times 6^{\_}) + (4 \times \_\_\_) + 1$ | $352_{six} = (3 \times 6^{\_}) + (5 \times \_\_\_) + \_\_\_$ |
| **3.** | $634_{eight} = (6 \times 8^{\_}) + (3 \times \_\_\_) + 4$ | $700_{eight} = (7 \times 8^{\_}) + (0 \times \_\_\_) + \_\_\_$ |
| **4.** | $387_{nine} = (3 \times 9^{\_}) + (8 \times \_\_\_) + 7$ | $584_{nine} = (5 \times 9^{\_}) + (8 \times \_\_\_) + \_\_\_$ |
| **5.** | $213 = (2 \times 10^{\_}) + (1 \times \_\_\_) + 3$ | $497 = (4 \times 10^{\_}) + (9 \times \_\_\_) + \_\_\_$ |

— Rename, using expanded notation and exponents.

**6.** $243_{five}$ = ____________________

**7.** $672_{eight}$ = ____________________

**8.** $78_{nine}$ = ____________________

**9.** $403_{five}$ = ____________________

**10.** $412_{six}$ = ____________________

**11.** $765_{nine}$ = ____________________

**12.** 2,941 = ____________________

**13.** $456_{eight}$ = ____________________

**14.** $543_{six}$ = ____________________

**15.** 2,345,600 = ____________________

— Rename, using a base-ten numeral.

**16.** $325_{six}$ = ____________________

**17.** $564_{eight}$ = ____________________

**18.** $333_{five}$ = ____________________

**19.** $778_{nine}$ = ____________________

WORK SPACE

# Numbers named by decimals

— Study the chart below. Each factor at the top of the chart, A, B, and C, is multiplied by 10, 100, 1,000, and 10,000.

| × | A<br>2.4 | B<br>0.54 | C<br>0.835 |
|---|---|---|---|
| 10 | 24.0 | 5.40 | 8.350 |
| 100 | 240.0 | 54.00 | 83.500 |
| 1,000 | 2,400.0 | 540.00 | 835.000 |
| 10,000 | 24,000.0 | 5,400.00 | 8,350.000 |

— Study the chart below. Each dividend at the top of the chart, A, B, and C, is divided by 10, 100, 1,000, and 10,000.

| ÷ | A<br>2,500 | B<br>42 | C<br>7.4 |
|---|---|---|---|
| 10 | 250 | 4.2 | 0.74 |
| 100 | 25 | 0.42 | 0.074 |
| 1,000 | 2.5 | 0.042 | 0.0074 |
| 10,000 | 0.25 | 0.0042 | 0.00074 |

— Write the answers to the following by placing the decimal point correctly.

**1.** 123.456 × 10 = ______

123.456 × 100 = ______

123.456 × 1,000 = ______

123.456 × 10,000 = ______

123.456 ÷ 10 = ______

123.456 ÷ 100 = ______

123.456 ÷ 1,000 = ______

123.456 ÷ 10,000 = ______

**2.** 24.68 × 10 = ______

24.68 ÷ 10 = ______

24.68 × 100 = ______

24.68 ÷ 100 = ______

24.68 × 1,000 = ______

24.68 ÷ 1,000 = ______

24.68 × 10,000 = ______

24.68 ÷ 10,000 = ______

**3.** 0.8 × 100 = ______

0.8 ÷ 1,000 = ______

0.8 × 10,000 = ______

0.8 × 1,000 = ______

0.8 ÷ 100 = ______

0.8 ÷ 10,000 = ______

**4.** 44 ÷ 10,000 = ______

44 ÷ 100 = ______

44 × 1,000 = ______

44 × 10,000 = ______

44 × 100 = ______

44 ÷ 1,000 = ______

| | a | b | c |
|---|---|---|---|
| **5.** | 8.4 ÷ 100 = ______ | 14.2 × 10 = ______ | 0.876 × 1,000 = ______ |
| **6.** | 6 ÷ 10 = ______ | 17.9 ÷ 100 = ______ | 1.45 × 10,000 = ______ |
| **7.** | 3.7 × 100 = ______ | 18 ÷ 1,000 = ______ | 0.05 × 10,000 = ______ |
| **8.** | 79 ÷ 10 = ______ | 9 ÷ 10,000 = ______ | 12 ÷ 10,000 = ______ |

# Multiplying and dividing by multiples of 10

— The first number named below has been multiplied or divided by 10, 100, 1,000, or 10,000, in order to obtain the second number. Show what has been done to the first number. The first two exercises are done for you.

| | FIRST NUMBER | | SECOND NUMBER | MULTIPLIED BY | DIVIDED BY |
|---|---|---|---|---|---|
| **1.** | 7.8 | → | 78 | 10 | |
| **2.** | 357.9 | → | 0.3579 | | 1,000 |
| **3.** | 12,345 | → | 1.2345 | | |
| **4.** | 6 | → | 6,000 | | |
| **5.** | 0.3 | → | 30 | | |
| **6.** | 0.5 | → | 0.005 | | |
| **7.** | 845 | → | 84.5 | | |
| **8.** | 1.2 | → | 0.00012 | | |
| **9.** | 123.456 | → | 0.0123456 | | |
| **10.** | 123.456 | → | 12,345.6 | | |
| **11.** | 123.456 | → | 12.3456 | | |
| **12.** | 123.456 | → | 0.123456 | | |
| **13.** | 123.456 | → | 1,234.56 | | |
| **14.** | 123.456 | → | 1.23456 | | |
| **15.** | 0.002 | → | 0.00002 | | |
| **16.** | 0.002 | → | 0.2 | | |
| **17.** | 0.002 | → | 0.0002 | | |
| **18.** | 0.002 | → | 2 | | |
| **19.** | 0.002 | → | 0.02 | | |

— If each number shown below is one factor, name the least multiple of 10 that can be used as the other factor to obtain a whole number product.

| | a | b | c |
|---|---|---|---|
| **20.** | 24.68 ____ | 123.456 ____ | 0.0002 ____ |
| **21.** | 927.5 ____ | 64.5132 ____ | 22.022 ____ |

# Dividing by a whole number

Study the example and check at the right.

To divide a fractional number named by a decimal by a whole number, you divide in the usual way, but you use a decimal point in the quotient directly above the decimal point in the dividend.

— Find the quotient, then check your answer on a separate sheet of paper. Locate the decimal point correctly.

$$\begin{array}{r}
5.78\\
8\overline{)46.24}\\
\underline{40\phantom{.24}}\\
6\;2\phantom{4}\\
\underline{5\;6\phantom{4}}\\
64\\
\underline{64}\\
0
\end{array}$$

CHECK:

$$\begin{array}{r}
5.78\\
\underline{\times 8}\\
46.24
\end{array}$$

| | a | b | c | d |
|---|---|---|---|---|
| 1. | $19\overline{)84.17}$ | $7\overline{)268.8}$ | $32\overline{)30.72}$ | $4\overline{)2.552}$ |
| 2. | $31\overline{)2.263}$ | $53\overline{)418.7}$ | $27\overline{)5.481}$ | $35\overline{)133.0}$ |
| 3. | $18\overline{)0.1152}$ | $14\overline{)75.88}$ | $13\overline{)27.3}$ | $17\overline{)1.87}$ |
| 4. | $36\overline{)183.6}$ | $51\overline{)28.56}$ | $45\overline{)3.465}$ | $29\overline{)171.1}$ |
| 5. | $38\overline{)101.46}$ | $25\overline{)203.75}$ | $21\overline{)256.2}$ | $32\overline{)771.2}$ |

# Dividing fractional numbers named by decimals

Study the examples at the right.

To divide two fractional numbers named by decimals, multiply both the dividend and the divisor by the same number to obtain a whole number divisor.

In example A, both the dividend and the divisor are multiplied by 10. In example B, they are both multiplied by 100.

**A**

$$\begin{array}{r} 2.4 \\ 1.8\overline{)4.3\,2} \\ \underline{3\,6}\phantom{0} \\ 7\,2 \\ \underline{7\,2} \\ 0 \end{array}$$

**B**

$$\begin{array}{r} 35. \\ 0.15\overline{)5.25} \\ \underline{4\,5}\phantom{0} \\ 75 \\ \underline{75} \\ 0 \end{array}$$

— Find the quotient. Check on a separate sheet of paper.

|  | a | b | c | d |
|---|---|---|---|---|
| 1. | $2.9\overline{)3.19}$ | $2.4\overline{)7.2}$ | $6.5\overline{)1.95}$ | $1.4\overline{)0.56}$ |
| 2. | $0.13\overline{)0.65}$ | $1.5\overline{)0.105}$ | $0.12\overline{)7.584}$ | $7.3\overline{)85.41}$ |
| 3. | $1.8\overline{)3.24}$ | $0.53\overline{)0.0265}$ | $2.4\overline{)0.0504}$ | $0.07\overline{)2.38}$ |
| 4. | $7.1\overline{)12.78}$ | $0.25\overline{)0.425}$ | $0.82\overline{)5.166}$ | $6.8\overline{)0.2312}$ |
| 5. | $4.9\overline{)42.63}$ | $0.29\overline{)0.2117}$ | $7.5\overline{)5.625}$ | $0.009\overline{)0.0891}$ |

# Zeros in the dividend

In some examples it is necessary to annex zeros in the dividend in order to multiply both dividend and divisor by the same power of 10.

Study the example and solution below.

$$\begin{array}{r} ? \\ 0.002\overline{)0.3} \end{array} \qquad \begin{array}{r} 150.\phantom{0} \\ 0.002_{\wedge}\overline{)0.300_{\wedge}} \\ \underline{2}\phantom{00.} \\ 10\phantom{0.} \\ \underline{10}\phantom{0.} \\ 0\phantom{.} \\ \underline{0}\phantom{.} \end{array}$$

In some examples it is necessary to annex zeros in the dividend in order to carry out the quotient until there is no remainder.

Study the example and solution below.

$$\begin{array}{r} ? \\ 0.4\overline{)1.22} \end{array} \qquad \begin{array}{r} 3.05 \\ 0.4_{\wedge}\overline{)1.2_{\wedge}20} \\ \underline{1\;2}\phantom{20} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

— Find the quotients. Check on a separate sheet of paper.

| | a | b | c | d |
|---|---|---|---|---|
| **1.** | $3.5\overline{)8.4}$ | $0.15\overline{)22.5}$ | $0.008\overline{)2.96}$ | $0.038\overline{)101.46}$ |
| **2.** | $0.36\overline{)9}$ | $0.24\overline{)0.12}$ | $0.06\overline{)409.8}$ | $0.005\overline{)0.021}$ |
| **3.** | $1.5\overline{)4.8}$ | $0.22\overline{)31.9}$ | $0.016\overline{)0.56}$ | $0.0004\overline{)72.8}$ |
| **4.** | $4.8\overline{)1.2}$ | $3.4\overline{)14.45}$ | $0.54\overline{)0.243}$ | $0.0065\overline{)4.225}$ |

# Nearest tenths and hundredths

To express a quotient to the nearest tenth, you name the dividend as hundredths, divide, and then round the quotient.

$$\begin{array}{r}
20.55\\
0.4_{\wedge}\overline{)8.2_{\wedge}20}\\
\underline{8}\phantom{220}\\
22\phantom{0}\\
\underline{20}\phantom{0}\\
20\\
\underline{20}\\
0
\end{array}$$

Rounded to the nearest tenth:

20.6

To express a quotient to the nearest hundredth, you name the dividend as thousandths, divide, and then round the quotient.

$$\begin{array}{r}
2.975\\
0.8_{\wedge}\overline{)2.3_{\wedge}800}\\
\underline{16}\phantom{800}\\
78\phantom{00}\\
\underline{72}\phantom{00}\\
60\phantom{0}\\
\underline{56}\phantom{0}\\
40\\
\underline{40}\\
0
\end{array}$$

Rounded to the nearest hundredth:

2.98

— Round each quotient to the nearest tenth.

| | | | | |
|---|---|---|---|---|
| **1.** | $0.6\overline{)4.5}$ | $2.4\overline{)10.2}$ | $0.8\overline{)6.832}$ | $0.006\overline{)1.23456}$ |
| **2.** | $3.2\overline{)8.426}$ | $0.9\overline{)8.231}$ | $0.16\overline{)0.5570}$ | $0.14\overline{)9.8364}$ |

— Round each quotient to the nearest hundredth.

| | | | | |
|---|---|---|---|---|
| **3.** | $0.13\overline{)0.45}$ | $3.1\overline{)78.41}$ | $0.07\overline{)0.526}$ | $0.14\overline{)2.9292}$ |
| **4.** | $0.28\overline{)11}$ | $12\overline{)6.78}$ | $0.5\overline{)2.468}$ | $3.12\overline{)5.4321}$ |

# Repeating decimals

Example A shows that the decimal for $\frac{2}{3}$ goes on and on without end. A numeral such as $0.666\overline{6}$ is a repeating decimal. The bar over the digit 6 means that the digit will keep repeating.

Example B shows how to find a decimal for $\frac{3}{7}$. A bar over the digits in the decimal $0.\overline{428571}$ means that if you keep dividing in example B, the digits 428571 will keep repeating.

— Divide to find the decimal that names each fraction. In some cases it will be necessary to express the quotient as a repeating decimal.

**A**

$$\begin{array}{r} 0.6666 \\ 3\overline{)2.0000} \\ \underline{1\;8}\phantom{000} \\ 20\phantom{00} \\ \underline{18}\phantom{00} \\ 20\phantom{0} \\ \underline{18}\phantom{0} \\ 20 \\ \underline{18} \\ 2 \end{array}$$

**B**

$$\begin{array}{r} 0.428571 \\ 7\overline{)3.000000} \\ \underline{2\;8}\phantom{00000} \\ 20\phantom{0000} \\ \underline{14}\phantom{0000} \\ 60\phantom{000} \\ \underline{56}\phantom{000} \\ 40\phantom{00} \\ \underline{35}\phantom{00} \\ 50\phantom{0} \\ \underline{49}\phantom{0} \\ 10 \\ \underline{7} \\ 3 \end{array}$$

| | a | b | c | d |
|---|---|---|---|---|
| **1.** | $\frac{7}{11}$ | $\frac{1}{80}$ | $\frac{41}{8}$ | $\frac{1}{625}$ |
| **2.** | $\frac{5}{12}$ | $\frac{3}{25}$ | $\frac{11}{200}$ | $\frac{131}{250}$ |
| **3.** | $\frac{3}{22}$ | $\frac{19}{40}$ | $\frac{76}{25}$ | $\frac{82}{333}$ |
| **4.** | $\frac{5}{14}$ | $\frac{5}{27}$ | $\frac{13}{400}$ | $\frac{13}{555}$ |

# Decimals and mixed forms

Mrs. Spratt made 4 aprons. The material for the aprons cost $1.75. The example at the right shows how to find the cost of each apron.

The remainder is expressed as a fraction.

$$\begin{array}{r} \$\ .43\frac{3}{4} \\ 4\overline{)\$1.75} \\ \underline{1\ 6\phantom{5}} \\ 15 \\ \underline{12} \\ 3 \end{array}$$

— Compute each answer. Express each remainder as a fraction.

| | a | b | c | d |
|---|---|---|---|---|
| **1.** | $7\overline{)2.39}$ | $2\overline{)\$5.11}$ | $8\overline{)0.75}$ | $5\overline{)1.12}$ |
| **2.** | $6\overline{)3.25}$ | $9\overline{)5.55}$ | $3\overline{)7.13}$ | $4\overline{)\$0.51}$ |
| **3.** | $2\overline{)\$13.47}$ | $7\overline{)67.00}$ | $5\overline{)61.41}$ | $8\overline{)96.83}$ |
| **4.** | $9\overline{)91.01}$ | $6\overline{)45.67}$ | $4\overline{)\$52.05}$ | $3\overline{)24.50}$ |
| **5.** | $7\overline{)5.463}$ | $2\overline{)9.911}$ | $8\overline{)1.6013}$ | $5\overline{)0.000432}$ |

# Practice

— Copy carefully and solve each example in the space provided below. Be sure the decimal is placed correctly when you copy your answer.

1. $2.2 + 0.3 + 5.7 + 9.0 =$ ________
2. $12.44 - 2.56 =$ ________
3. $1.9 \times 2.6 =$ ________
4. $1.776 \div 0.08 =$ ________
5. $54.03 \times 0.09 =$ ________
6. $148 \div 0.5 =$ ________
7. $231 \div 0.77 =$ ________
8. $0.781 + 2.934 + 11.003 =$ ________
9. $0.01 \times 0.001 =$ ________
10. $243.78 - 18.99 =$ ________
11. $25.003 + 18.465 + 62.126 =$ ________
12. $0.36 \times 9.3 =$ ________
13. $15.64 \div 4.6 =$ ________
14. $8.4 \div 0.28 =$ ________
15. $91.87 \times 0.4 =$ ________
16. $1.045 \div 0.011 =$ ________
17. $85.9 \times 7.9 =$ ________
18. $24.60 - 1.23 =$ ________

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 |

# Problem Test 6

**1.** Last year Denis was $47\frac{3}{4}$ inches tall. He is $49\frac{1}{2}$ inches tall this year. How much did Denis grow in a year? _____

**2.** Mr. Kane bought 100 tomato plants for $6.75. To the nearest cent, what was the cost per plant? _____

**3.** If floor covering sells at $4.89 a square yard, it will cost _____ to cover a floor 18 feet by 15 feet.

**4.** It takes Jack $1\frac{3}{4}$ hours to deliver his papers each day. How many hours does it take him per week of seven days? _____

**5.** Mr. Bailey drove his car 432 miles using 25.6 gallons of gasoline. To the nearest tenth, how many miles did he average per gallon? _____

**6.** In one city, noon temperatures for a week were reported as follows: Monday 72°, Tuesday 79°, Wednesday 65°, Thursday 60°, Friday 52°, Saturday 48°, Sunday 59°. The average noon temperature for the week was _____.

**7.** The Smiths burned 216 gallons of fuel oil during the month of November. This is an average of _____ gallons per day.

**8.** A weather bureau reported the rainfall for the year as 61.44 inches. This is an average of _____ inches per month.

**9.** To hit a home run over center field in Yankee Stadium, a player must hit the ball 461 feet. How many yards must he hit it? _____

**10.** How many feet are there in the distance around a football field 160 feet wide and 120 yards long, from goal post to goal post? _____

Number correct: _____. Date: ____________ ____, ______.
Write your score on the Problem Test Record on page 160. Fill in the sixth bar in the Problem Test graph form on page 160.

| | |
|---|---|
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |
| 7 | 8 |
| 9 | 10 |

## Review

**1.** $\begin{array}{r} 54.2 \\ +7.9 \\ \hline \end{array}$ $\quad$ $\begin{array}{r} 32.41 \\ -8.78 \\ \hline \end{array}$ $\quad$ $\begin{array}{r} 8.000 \\ -2.732 \\ \hline \end{array}$

**2.** $\begin{array}{r} 508 \\ \times 304 \\ \hline \end{array}$ $\quad$ $\begin{array}{r} 1.35 \\ \times 7.9 \\ \hline \end{array}$ $\quad$ $\begin{array}{r} 0.02 \\ \times 0.3 \\ \hline \end{array}$

**3.** $100 \times 2.675 =$ ________

**4.** $27.9 \div 100 =$ ________

**5.** $8\frac{3}{4} \div 1\frac{1}{4} =$

**6.** $\begin{array}{r} 5\frac{3}{8} \\ +4\frac{1}{2} \\ \hline \end{array}$ $\quad$ $\begin{array}{r} 3\frac{5}{6} \\ +2\frac{3}{4} \\ \hline \end{array}$

**7.** $\begin{array}{r} 9\frac{7}{8} \\ -3\frac{3}{4} \\ \hline \end{array}$ $\quad$ $\begin{array}{r} 7\frac{1}{3} \\ -3\frac{3}{4} \\ \hline \end{array}$

**8.** $3 \times 2\frac{1}{2} =$

**9.** $7\frac{1}{2} \times 4\frac{2}{3} =$

**10.** $10 \div 2\frac{1}{2} =$

**11.** $\frac{7}{8} \div \frac{1}{4} =$

## Progress Test 6

**1.** Rename the fraction $\frac{2}{3}$ using a decimal. ________

**2.** Which is greater, 0.65 or $\frac{3}{4}$? ______

**3.** What is the perimeter of a square 6.5 feet on each side? ________

**4.** Rename $451_{six}$ using a base-ten numeral. ______

**5.** Rename using exponents.

$12 \times 12 =$ ______

$50 \times 50 \times 50 =$ ______

$9 \times 9 \times 9 \times 9 \times 9 \times 9 =$ ____

WORK SPACE

**6.** Round to the nearest hundredth:

17.995 ________ $\quad$ 9.905 ________

**7.** $2.9\overline{)15.66}$

**8.** $0.42\overline{)8.946}$

— Express each remainder as a fraction.

**9.** $7\overline{)\$6.25}$

**10.** $5\overline{)90.37}$

Number correct: ______. Date: ______________ ____, ________.
Write your score on the Progress Test Record on page 160. Fill in the sixth bar in the Progress Test graph form on page 160.

# Ratio

Shown at the right is a diagram of the seating arrangement in Miss Lewis's sixth-grade class.

|  | Row 1 | Row 2 | Row 3 | Row 4 | Row 5 |
|---|---|---|---|---|---|
| **Seat 6** | Girl |  | Boy |  | Girl |
| **Seat 5** | Boy | Girl | Boy | Boy | Girl |
| **Seat 4** | Girl | Boy | Girl | Boy | Boy |
| **Seat 3** | Boy | Girl | Boy | Girl | Girl |
| **Seat 2** | Girl | Girl | Boy | Boy | Girl |
| **Seat 1** | Girl | Boy | Girl | Girl | Girl |

**1.** How many students are in her class? _____ How many girls are there? _____ How many boys are there? _____

**2.** The ratio of the number of girls to the number of students in the class is $\frac{16}{28}$, or _____.

**3.** The ratio of the number of boys to the number of students is $\frac{12}{28}$, or _____.

— In simplest terms, what is the ratio of the number of:

**4.** girls in row 1 to boys in row 1? _____ row 3? _____ row 5? _____

**5.** boys in row 2 to girls in row 2? _____ row 4? _____

**6.** girls in row 1 to girls in row 5? _____

**7.** boys in row 4 to boys in row 3? _____

**8.** girls in row 2 to boys in row 4? _____

**9.** girls in the first seat to boys in the first seat? _____

**10.** boys in the second seat to girls in the second seat? _____

**11.** girls in the third seat to boys in the third seat? _____

**12.** boys in the fourth seat to girls in the fourth seat? _____

**13.** girls in the fifth seat to boys in the fifth seat? _____

**14.** boys in the sixth seat to girls in the sixth seat? _____

**15.** girls in the class to boys in the class? _____

**16.** boys in the class to girls in the class? _____

— In your class, what is the ratio of the number of:

**17.** boys to girls in each row? _____

girls to boys in each row? _____

**18.** students in each row to total students? _____

# Problem solving

WORK SPACE

**1.** Central High School has 395 freshmen, 300 sophomores, 250 juniors, and 225 seniors. In simplest terms, what is the ratio of the number of:

**a** juniors to sophomores? _____

**b** freshmen to seniors? _____

**c** freshmen and seniors to sophomores and juniors? _____ .

**d** seniors to the rest of the students? _____

**e** freshmen to the entire school? _____

**2.** Last Halloween Bobby collected 68 pieces of candy and $1.30. His brother Steven collected 84 pieces of candy and $.95. In simplest terms, what is the ratio of the amount of:

**a** Bobby's candy to Steven's candy? _____

**b** Bobby's money to Steven's money? _____

**c** Steven's candy to Bobby's candy? _____

**d** Steven's money to Bobby's money? _____

**e** Bobby's candy to the candy collected between them? _____

**f** Steven's candy to the candy collected between them? _____

**g** Bobby's money to the money collected between them? _____

**h** Steven's money to the money collected between them? _____

**3.** Virginia got 36 problems right, 10 wrong, and left out 4 on her last mathematics test. In simplest terms, what is the ratio of the number of:

**a** her correct answers to her wrong answers? _____

**b** her correct answers to the entire test? _____

**c** her incorrect answers to the entire test? _____

**d** problems she left out to the entire test? _____

**4.** Tom is 12 years old. His father is 42 years old. In lowest terms, what is the ratio of Tom's age to his father's age? _____ Tom's father's age to Tom's age? _____ Tom is _____ as old as his father. His father is _____ times as old as Tom.

# Proportions

The fractions $\frac{5}{6}$ and $\frac{10}{12}$ name the same ratio. A true sentence such as $\frac{5}{6} = \frac{10}{12}$ is called a **proportion.**

There are two ways of solving a proportion, (a) using a common numerator or denominator, and (b) using the relationship of multiplication and division. Study these examples.

| **A** $\frac{3}{5} = \frac{n}{40}$ | **B** $\frac{12}{n} = \frac{2}{3}$ | **C** $\frac{n}{5} = \frac{7}{15}$ | **D** $\frac{9}{n} = \frac{3}{14}$ |
|---|---|---|---|
| $\frac{8}{8} \times \frac{3}{5} = \frac{n}{40}$ | $\frac{12}{n} = \frac{6}{6} \times \frac{2}{3}$ | $n \div 5 = \frac{7}{15}$ | $9 \div n = \frac{3}{14}$ |
| $\frac{24}{40} = \frac{n}{40}$ | $\frac{12}{n} = \frac{12}{18}$ | $n = \overset{1}{\cancel{5}} \times \frac{7}{\underset{3}{\cancel{15}}}$ | $9 = n \times \frac{3}{14}$ |
| $n = 24$ | $n = 18$ | $n = \frac{7}{3}$, or $2\frac{1}{3}$ | $9 \div \frac{3}{14} = n$ |
| | | | $\overset{3}{\cancel{9}} \times \frac{14}{\underset{1}{\cancel{3}}} = n$ |
| | | | $42 = n$ |

Find the value of $n$ in these proportions. Show your work.

| | **A** $\frac{7}{8} = \frac{n}{32}$ | **B** $\frac{36}{n} = \frac{9}{18}$ | **C** $\frac{n}{3} = \frac{28}{21}$ | **D** $\frac{9}{n} = \frac{6}{8}$ |
|---|---|---|---|---|
| **1.** | | | | |

Find the value of $n$ in these proportions. Do your work on separate paper.

| | **a** | **b** | **c** |
|---|---|---|---|
| **2.** | $\frac{6}{14} = \frac{n}{28}$ $n =$ ______ | $\frac{3}{11} = \frac{n}{99}$ $n =$ ______ | $\frac{5}{7} = \frac{n}{35}$ $n =$ ______ |
| **3.** | $\frac{n}{7} = \frac{40}{56}$ $n =$ ______ | $\frac{n}{12} = \frac{35}{60}$ $n =$ ______ | $\frac{n}{4} = \frac{91}{28}$ $n =$ ______ |
| **4.** | $\frac{3}{10} = \frac{21}{n}$ $n =$ ______ | $\frac{n}{35} = \frac{6}{14}$ $n =$ ______ | $\frac{6}{11} = \frac{n}{44}$ $n =$ ______ |
| **5.** | $\frac{36}{n} = \frac{6}{9}$ $n =$ ______ | $\frac{24}{n} = \frac{4}{11}$ $n =$ ______ | $\frac{35}{49} = \frac{5}{n}$ $n =$ ______ |
| **6.** | $\frac{3}{8} = \frac{6}{n}$ $n =$ ______ | $\frac{5}{14} = \frac{n}{56}$ $n =$ ______ | $\frac{2}{9} = \frac{n}{81}$ $n =$ ______ |

# Using proportions

$$\frac{8}{5} = \frac{24}{n}$$

$$\frac{3}{3} \times \frac{8}{5} = \frac{24}{n}$$

$$\frac{24}{15} = \frac{24}{n}$$

$$15 = n$$

**1.** Mr. Hanson is recovering a chair. He needs 24 brass tacks that sell at 8 for 5¢.

To find the cost of 24 tacks you can solve the proportion as shown in the box.

How much did Mr. Hanson pay for 24 tacks? _____

**2.** At 3 for 25¢, find the cost of 15 oranges.

_____

Show your work in the box.

**3.** Find the cost of 16 plums at 4 for 15¢.

_____

Show your work in the box.

— Find the cost. Do your work on separate paper.

| | a | b |
|---|---|---|
| **4.** | 3 dozen lemons at 3 for 20¢ _____ | 9 bars of laundry soap at 3 for 25¢ _____ |
| **5.** | 8 cans of beets at 2 for 39¢ _____ | 5 cans of orange soda at 2 for 29¢ _____ |
| **6.** | 18 sugar buns at 6 for 50¢ _____ | 20 birthday party favors at 4 for 39¢ _____ |

**7.** If walnuts sell for $1.20 a pound, 12 ounces of walnuts would cost _____.

**8.** The ratio of the number of boys to the number of girls in one class is 4 to 7. If there are 12 boys, how many girls are there?

_____

**9.** If thirty pencils cost 55 cents, how much would six pencils cost? _____

**10.** On a test, the ratio of the number of pupils that passed to the number of pupils that failed was 7 to 2. If 21 passed, how many failed? _____

| 7 | 8 | 9 | 10 |
|---|---|---|---|
| | | | |

# Problem solving

**1.** If a man with a height of 6 feet casts a nine-foot shadow, how high is a pole that casts a thirty-foot shadow? ________

**2.** If Golden Grimes apples sell at 2 for 25¢, how much would you have to pay for 2 dozen? ________

**3.** In basketball practice, Fred made 2 baskets in 5 tries. At that rate, how many baskets would he make in 30 tries? ________

**4.** In mixing weed killer, Mr. Long uses 5 gallons of water to each 3 ounces of weed poison. How much water should he use to mix with 24 ounces of weed poison? ________

**5.** The ratio of the number of children to the number of adults at the school fair was 7 to 5. If there were 238 children, how many adults were there? ______

**6.** Joyce is making a poster. She wants the ratio of the width to the height to be 4 to 3. If she makes it 24 inches wide, its height must be ______ inches.

**7.** If there are 600 pupils in a school and 4 out of 5 travel by bus, how many pupils travel by bus? ______

**8.** A man drives 96 miles in 3 hours. If he drives at the same rate, how long will it take him to drive a distance of 160 miles?

________

**9.** The length of a back yard is 64 feet. The ratio of the length to the width is 8 to 5. How many feet wide is the yard? ______

| |
|---|
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |
| 7 |
| 8 |
| 9 |

# Finding per cents for ratios

The ratio 25 to 100, or $\frac{25}{100}$ compares the number 25 to 100. A special name for $\frac{25}{100}$ is 25%, read "25 per cent."

To name the ratio 6 to 25, or $\frac{6}{25}$, by a per cent, you find an equivalent fraction with a denominator of 100. Study example A.

To name a ratio such as $\frac{3}{11}$ by a per cent, it is easier to use the relationship between multiplication and division, since 11 is not a factor of 100. Study example B.

**A** $\frac{6}{25} = \frac{4}{4} \times \frac{6}{25} = \frac{24}{100} = 24\%$

**B**

$$\frac{3}{11} = \frac{n}{100}$$

$$\frac{3}{11} = n \div 100$$

$$\frac{3}{11} \times 100 = n$$

$$\frac{300}{11} = n$$

$$27\tfrac{3}{11} = n$$

$$\text{So } \frac{3}{11} = \frac{27\frac{3}{11}}{100}, \text{ or } 27\tfrac{3}{11}\%$$

— Name each ratio by a per cent.

| | a | b | c |
|---|---|---|---|
| **1.** | $\frac{7}{20}$ | $\frac{11}{50}$ | $\frac{2}{5}$ |
| **2.** | $\frac{18}{10}$ | $\frac{22}{25}$ | $\frac{5}{4}$ |
| **3.** | $\frac{9}{16}$ | $\frac{3}{13}$ | $\frac{5}{8}$ |
| **4.** | $\frac{8}{24}$ | $\frac{11}{40}$ | $\frac{7}{9}$ |
| **5.** | $\frac{10}{4}$ | $\frac{31}{50}$ | $\frac{21}{35}$ |
| **6.** | $\frac{9}{22}$ | $\frac{8}{4}$ | $\frac{12}{25}$ |

# Finding a per cent of a number

**1.** Of the 740 students in Central School, 55% are boys. To find how many boys are in the school, rename 55% as 0.55 and multiply as shown in the box at the right.

$$\begin{array}{r} 7\ 40 \\ \times 0.55 \\ \hline 37\ 00 \\ 370\ 0\phantom{0} \\ \hline 407.00 \end{array}$$

There are ______ boys in Central School.

**2.** Of the 740 students in Central School, 45% are girls. What is another name for 45%? ______ Complete the example in the box.

$$\begin{array}{r} 7\ 40 \\ \times 0.45 \\ \hline \end{array}$$

There are ______ girls in Central School.

— Find the answers.

**3.** 23% of 800 = ______

**4.** 95% of 90 = ______

**5.** 57% of 42 = ______

**6.** 45% of 504 = ______

**7.** 82% of 55 = ______

**8.** 90% of 182 = ______

WORK SPACE

**9.** One way to find $66\frac{2}{3}\%$ of 63 is to multiply 63 by $0.66\frac{2}{3}$ as shown in the box. The partial product 42 is the result of multiplying $\frac{2}{3}$ and 63.

Another way to find $66\frac{2}{3}\%$ of 63 is to use an equivalent fraction for the per cent. $\frac{2}{3} \times 63 =$ ______

$$\begin{array}{r} 63 \\ \times 0.66\frac{2}{3} \\ \hline 42 \\ 3\ 78 \\ 37\ 8\phantom{0} \\ \hline 42.00 \end{array}$$

— Study the chart. Then find the answers below using an equivalent fraction.

**10.**

| PER CENT | $33\frac{1}{3}\%$ | $66\frac{2}{3}\%$ | $12\frac{1}{2}\%$ | $37\frac{1}{2}\%$ | $62\frac{1}{2}\%$ | $87\frac{1}{2}\%$ |
|---|---|---|---|---|---|---|
| FRACTION | $\frac{1}{3}$ | $\frac{2}{3}$ | $\frac{1}{8}$ | $\frac{3}{8}$ | $\frac{5}{8}$ | $\frac{7}{8}$ |

**11.** $12\frac{1}{2}\%$ of 104 = ______

**12.** $33\frac{1}{3}\%$ of 237 = ______

**13.** $87\frac{1}{2}\%$ of 96 = ______

**14.** $66\frac{2}{3}\%$ of 534 = ______

**15.** $37\frac{1}{2}\%$ of 208 = ______

**16.** $62\frac{1}{2}\%$ of 400 = ______

WORK SPACE

# Discounts

WORK SPACE

**1.** A building supply company allows a discount of 10% for cash. On a bill for $75.00, the cash discount is 10% of $75.00, or ______. The cash price is $75.00 minus $7.50, or ______.

Find the discount and cash price of the following purchases.

- $45.00 ______ ______
- $84.00 ______ ______
- $96.00 ______ ______

**2.** Mr. Jensen works in an electric-appliance store. He is allowed 12% discount on appliances he buys. How much will he pay for an electric toaster, if the original price is $15.00? ______

Find how much he will pay for these purchases.

- a radio priced at $45. ______
- an iron priced at $12.50. ______
- a fan priced at $36. ______

**3.** At a recent sale, a music store allowed 15% discount on an $840 piano. How much was the discount? ______ What was the cash price? ______

**4.** A $375 television set was on sale at "20% off." How much was the discount? ______ What was the cash price? ______

**5.** The Atlantic Book Store gives students a 20% discount. Last year, the store sold math books that were worth $150, social studies books worth $220, English books worth $370, and other books worth $180.

- What was the total value of the books? ______
- What was the discount? ______
- How much did the students pay? ______

# Finding a per cent of increase or decrease

### INCREASE

**1.** A camera that sold for $20 now sells for $24. What per cent of the original price does the increase represent?

▶ First find the increase in price.

24 – 20 = ______

▶ Then find what per cent of the original price the increase represents.

$\frac{4}{20} = \frac{n}{100}$ The price increased ______%.

**2.** Last year Don's brother weighed 110 pounds. Now he weighs 143 pounds. What is the per cent of increase in his weight?

______ Show your work below.

**3.** Ten years ago, the population of a town was 12,000. Today the population is 14,400. What is the per cent of increase in the population? ______

**4.** Last year there were 240 children at a school picnic. This year there were 288 children. What was the per cent of increase in the number of children at the school picnic? ______

**5.** Last year Mike earned $120 shoveling snow and mowing lawns. This year Mike earned $138. What was the per cent of increase in his earnings? ______

### DECREASE

**1.** At a sale a $120 record player is reduced to $108. What per cent of the original price does the decrease represent?

▶ First find the decrease in price.

120 – 108 = ______

▶ Then find what per cent of the original price the decrease represents.

$\frac{12}{120} = \frac{n}{100}$ The price decreased ______%.

**2.** Bobby had 60 marbles. Now he has only 24 marbles. What is the per cent of decrease in the marbles he had? ______ Show your work below.

**3.** Sally's parents paid $3,200 for a car last year. They traded it in this year for $2,400. What was the per cent of decrease in its value? ______

**4.** Last month 16 pupils in a class were absent at some time or other. This month there were 14 pupils absent. Find the per cent of decrease in the number of pupils absent. ______

**5.** A stereo-phonograph priced at $340 was marked down at an anniversary sale to $289. What was the per cent of decrease in the price? ______

# Commissions

**1.** Paul receives 10% commission for selling programs at football games. Last fall, his total sales were $500. How much commission did he earn? ______

$\frac{1}{10} \times 500 =$ ______

**2.** Ted sold $35 worth of magazine subscriptions. His commission was $7. What per cent of his sales was Ted's commission?

______

$\frac{7}{35} = \frac{1}{5} = 0.20$, or

______%

**3.** Bob's cub pack sold $660 worth of candy and was given $99 as commission. What per cent of the total sales is this commission?

______

**4.** How much would Mr. Newton get for selling a $1,900 car if he gets a 3% commission? ______

**5.** Mr. Parks got $1,110 commission for selling a house for $18,500. What was his rate of commission? ______

**6.** Mr. Rogers gets a 4% commission for his sales. One day he sold twelve $6 articles and three $9 articles. How much did his sales total? ______ What was his commission? ______

**7.** Mr. May gets $50 a week plus a 5% commission for his sales. One week his sales totaled $640. What was his commission? ______ How much did he earn all together? ______

**8.** Mr. Allen gets a 5% commission on cars he sells for less than $2,000 and a 6% commission on cars he sells for more than $2,000. One week he sold a car for $1,900 and another for $3,200.

What was his commission on the $1,900 car? ______ What was his commission on the $3,200 car? ______

How much commission did he earn all together? ______

---

WORK SPACE

# Problem Test 7

**1.** Bill did 56 problems correctly out of 80 on a test. What per cent of the problems did Bill get correct? ______

**2.** The estimated annual flow of water over Guaira Falls is 470,000 cubic feet per second. For Niagara Falls it is 212,200 cubic feet per second. How much greater is the annual flow of water over Guaira Falls? ______________

**3.** What per cent of the sales must the commission be to earn $400 on sales of $3,200? ______

**4.** The ratio of Gary's weight to his father's weight is 2 to 5. If Gary weighs 72 pounds, how much does his father weigh? ______

**5.** Tim made 32% of the 950 points scored by his basketball team this season. How many points did Tim make? ______

**6.** A gasoline engine uses 2.75 gallons of fuel an hour. How long will it run on 55 gallons of gasoline? ________

**7.** Mr. Jackson paid $2,400 for his car three years ago. He was allowed $800 when he traded it for a new one. What per cent did the car decrease in value? ______

**8.** On a camping trip a scout troop rode 26.3 miles by bus and hiked 4.6 miles. Returning, they hiked 6.8 miles and rode 22.9 miles. In all, the boys traveled ______ miles.

**9.** Total sales this month of the Century Company were $6,400. Last month they were $5,600. By what per cent did the sales increase? ______

**10.** A fifty-yard swimming record was 32.4 seconds for the backstroke and 29.5 seconds for the breaststroke. How much faster was the breaststroke record? ______

Number correct: ______. Date: ____________ ____, ________.
Write your score in the Problem Test Record on page 160. Fill in the seventh bar on the Problem Test graph form on page 160.

| | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | 6 |
| 7 | 8 |
| 9 | 10 |

# Review

**1.**

$$\begin{array}{rrr} 4{,}550 & 6{,}543 & 43{,}216 \\ 9{,}669 & 8{,}765 & 57{,}432 \\ 5{,}372 & 8{,}762 & 60{,}004 \\ 4{,}632 & 7{,}654 & 84{,}570 \\ +9{,}383 & +2{,}310 & +32{,}986 \\ \hline \end{array}$$

**2.**

$$\begin{array}{rr} 7{,}324 & 5{,}000{,}432 \\ -2{,}658 & -1{,}234{,}158 \\ \hline \end{array}$$

**3.**

$$\begin{array}{rr} 2\frac{3}{4} & 8\frac{1}{5} \\ +5\frac{2}{3} & -2\frac{3}{4} \\ \hline \end{array}$$

**4.** $2\frac{2}{3} \times 2\frac{1}{4} =$

**5.** $2\frac{1}{5} \div 6 =$

**6.** $87\overline{)48{,}024}$ $\qquad$ $36\overline{)25{,}488}$

**7.**

$$\begin{array}{rr} 4{,}692 & 9{,}456 \\ \times\ \ 89 & \times\ \ 76 \\ \hline \end{array}$$

# Progress Test 7

**1.** What repeating decimal names the same number as $\frac{2}{3}$? ______

**2.** Find the average of 12.6, 8.7, 6.0, and 11.9 to the nearest tenth. ______

**3.** What part of a mile is the 440-yard dash? ______

**4.** Art drove 120 miles in $2\frac{1}{4}$ hours. His average rate was ______ miles an hour.

**5.** Find the perimeter of a hexagon if each side is 2.5 inches. ______

**6.** Name $\frac{5}{8}$ as a per cent. ______

**7.** Find 28% of 375. ______

**8.** To the nearest cent find the discount when the original price is $59.95 and the discount is 2%. ______

**9.** Find the per cent of decrease of a radio at $45 marked down to $36. ______

**10.** Joan is allowed 20% commission for selling $35 worth of greeting cards. Her commission is ______.

Number correct: ______. Date: ____________ ____, ________.
Write your score in the Progress Test Record on page 160. Fill in the seventh bar on the Progress Test graph form on page 160.

# Names for rational numbers

You know that the ratio of 1 to 3 is $\frac{1}{3}$, a fractional number. It is also called a rational number. The word *rational* is taken from *ratio*.

You can think of rational numbers as numbers that can be expressed as the ratio of a whole number to a counting number. For example:

$$4.3 = 4\frac{3}{10} = \frac{43}{10} \qquad 13\% = \frac{13}{100} \qquad 7\frac{1}{2} = \frac{15}{2} \qquad 0.002 = \frac{2}{1{,}000}$$

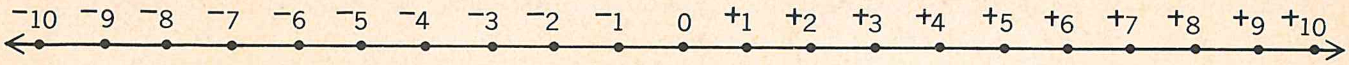
- Show that each of the following names a rational number by expressing it as the ratio of a whole number to a counting number.

| | a | b | c |
|---|---|---|---|
| **1.** | 0.065 | $5\frac{2}{7}$ | 28% |
| **2.** | 115% | $7\frac{1}{3}$ | 0.104 |
| **3.** | 0.45 | $1\frac{3}{11}$ | 16% |
| **4.** | 72% | $2\frac{2}{3}$ | 0.025 |
| **5.** | 0.750 | $8\frac{5}{9}$ | 235% |
| **6.** | 38% | $14\frac{2}{5}$ | 2.02 |
| **7.** | 6.6 | $12\frac{1}{2}$ | 48% |
| **8.** | 0.008 | $7\frac{4}{5}$ | $40\frac{1}{3}$ |

- For each rational number in column **a** there is another name in column **b** and column **c**. Draw line segments to connect them. The first one is done for you.

| | | | |
|---|---|---|---|
| **9.** | $\frac{16}{10}$ | $66\frac{2}{3}\%$ | 1.6 |
| **10.** | $\frac{2}{3}$ | $1\frac{6}{10}$ | $\frac{200}{300}$ |
| **11.** | $\frac{7}{8}$ | $4\frac{3}{100}$ | $\frac{700}{800}$ |
| **12.** | $\frac{84}{10}$ | $87\frac{1}{2}\%$ | $8\frac{4}{10}$ |
| **13.** | $\frac{403}{100}$ | 8.4 | 4.03 |

# Positive and negative numbers



Numbers shown at the right of 0 are numbers greater than 0, or positive numbers. The numeral for positive ten is written as $^{+}10$.

Numbers shown at the left of 0 are numbers less than 0, or negative numbers. The numeral for negative ten is written as $^{-}10$.

— Write the numeral for the positive or negative number you could use for each of the numbers named in these sentences.

**1.** The temperature dropped 7°. ______

**2.** John found $3. ______

**3.** The car slowed down 8 mph. ______

**4.** 5 people left the room. ______

**5.** 4 people entered the room. ______

**6.** The price went up $4. ______

**7.** Steve found 20 marbles. ______

**8.** The price dropped 15¢. ______

**9.** There was a $6 loss. ______

**10.** The rent went up $8. ______

**11.** The car increased speed 10 mph. ______

**12.** 11 students joined our club. ______

**13.** 6 students left our club. ______

**14.** The clock is 6 minutes slow. ______

**15.** Our team gained 12 yards on the last play. ______

**16.** The temperature last Thursday averaged 4° above zero. ______

**17.** The submarine was cruising 200 feet below sea level. ______

**18.** The plane was flying 2,000 feet above sea level. ______

**19.** The store made a $12 profit on one article. ______

**20.** Our team was 2 runs behind in the seventh inning. ______

**21.** What point is 8 to the right on the number line? ______

**22.** What point is 7 to the left on the number line? ______

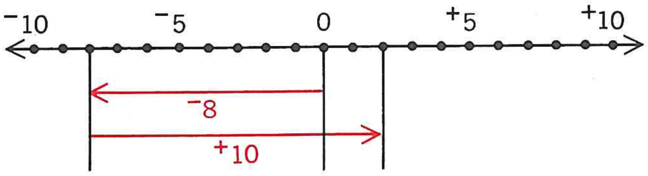
**23.** Our football team was 3 points ahead at the end of the first quarter. ______

**24.** The temperature dropped to 4° below zero this afternoon. ______

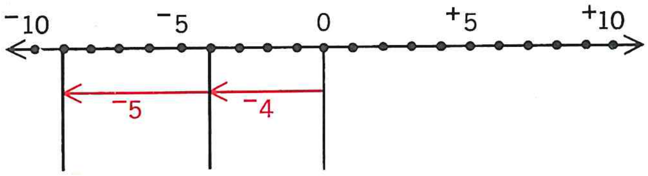
**25.** Our teacher gave us 5 more problems for homework. ______

# Addition of positive and negative numbers

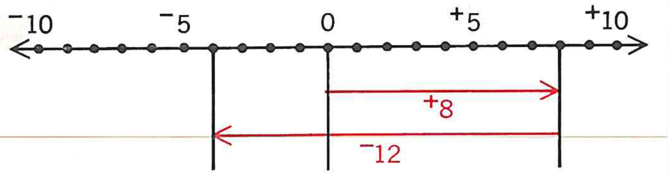
— Study each number line below; then solve the addition sentence.



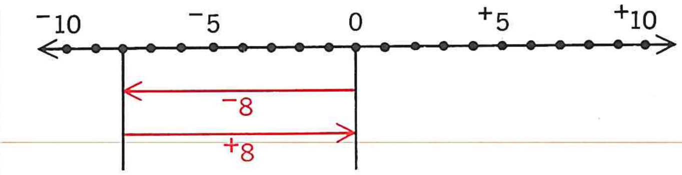
1. $^{-}8 + {}^{+}10 =$ ______



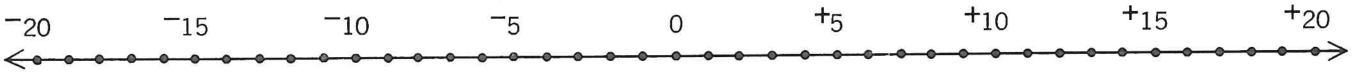
2. $^{-}4 + {}^{-}5 =$ ______



3. $^{+}8 + {}^{-}12 =$ ______



4. $^{-}8 + {}^{+}8 =$ ______



— Solve these sentences. You may use the number line above to help you solve some of the sentences.

| | a | b | c |
|---|---|---|---|
| **5.** | $^{-}8 + {}^{+}15 =$ ______ | $^{-}16 + {}^{-}14 =$ ______ | $^{-}19 + {}^{+}7 =$ ______ |
| **6.** | $^{+}40 + {}^{+}10 =$ ______ | $^{-}30 + {}^{+}30 =$ ______ | $^{-}15 + {}^{-}17 =$ ______ |
| **7.** | $^{-}42 + {}^{+}18 =$ ______ | $^{+}17 + {}^{-}40 =$ ______ | $^{-}63 + {}^{+}11 =$ ______ |
| **8.** | $^{+}27 + {}^{+}27 =$ ______ | $^{-}91 + {}^{+}91 =$ ______ | $^{+}112 + {}^{-}52 =$ ______ |
| **9.** | $^{+}71 + {}^{-}33 =$ ______ | $^{-}82 + {}^{+}28 =$ ______ | $^{-}17 + {}^{+}35 =$ ______ |
| **10.** | $^{+}58 + {}^{-}12 =$ ______ | $^{+}53 + {}^{-}17 =$ ______ | $^{+}72 + {}^{+}48 =$ ______ |
| **11.** | $^{-}12 + {}^{+}83 =$ ______ | $^{-}9 + {}^{+}34 =$ ______ | $^{-}16 + {}^{-}19 =$ ______ |
| **12.** | $^{-}68 + {}^{+}68 =$ ______ | $^{-}281 + {}^{+}123 =$ ______ | $^{+}142 + {}^{-}356 =$ ______ |

WORK SPACE

Try these

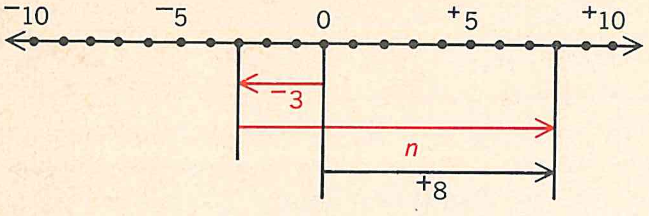
| | | | |
|---|---|---|---|
| **13.** | $\frac{^{-}2}{3} + \frac{^{+}3}{4} =$ ______ | $\frac{^{+}7}{8} + \frac{^{-}1}{2} =$ ______ | $\frac{^{+}5}{8} + \frac{^{-}1}{4} =$ ______ |
| **14.** | $\frac{^{+}1}{3} + \frac{^{-}5}{6} =$ ______ | $\frac{^{-}2}{5} + \frac{^{+}3}{4} =$ ______ | $^{-}1\frac{1}{2} + {}^{+}2\frac{1}{3} =$ ______ |

# Subtraction of positive and negative numbers

To solve a sentence such as $^+3 - {}^-4 = n$, you use an addition sentence, $^-4 + n = {}^+3$. Think, $^-4$ plus what gives $^+3$? $n = {}^+7$

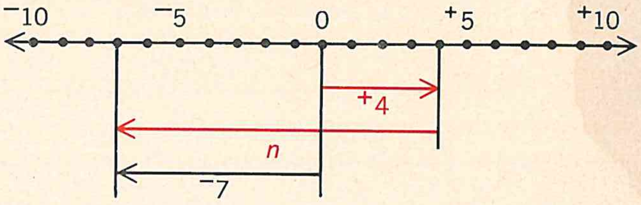
— Solve each sentence in Ex. 1 to 4. Use the addition sentence below the number line. The arrows on the number line show you how to find the answer.

**1.** $^+8 - {}^-3 = n$



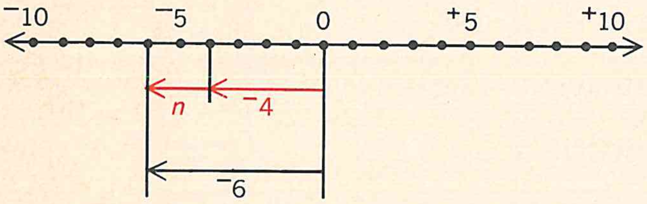
$^-3 + n = {}^+8$ $\qquad n =$ ______

**2.** $^-7 - {}^+4 = n$



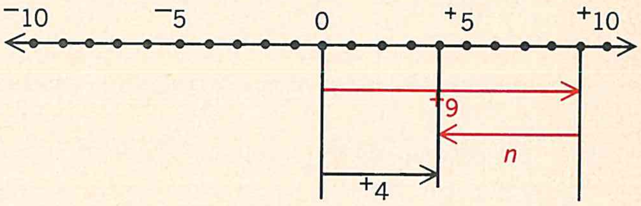
$^+4 + n = {}^-7$ $\qquad n =$ ______

**3.** $^-6 - {}^-4 = n$



$^-4 + n = {}^-6$ $\qquad n =$ ______

**4.** $^+4 - {}^+9 = n$



$^+9 + n = {}^+4$ $\qquad n =$ ______

— Use sentence **b** to solve sentence **a**. You may use the number line on page 154 to help you solve some of the sentences.

| | **a** | | **b** | | |
|---|---|---|---|---|---|
| **5.** | $^-9 - {}^+3 = n$ | → | $^+3 + n = {}^-9$ | → | $n =$ ______ |
| **6.** | $^-7 - {}^-5 = n$ | → | $^-5 + n = {}^-7$ | → | $n =$ ______ |
| **7.** | $^+12 - {}^+6 = n$ | → | $^+6 + n = {}^+12$ | → | $n =$ ______ |
| **8.** | $^+3 - {}^-17 = n$ | → | $^-17 + n = {}^+3$ | → | $n =$ ______ |
| **9.** | $^+42 - {}^+20 = n$ | → | $^+20 + n = {}^+42$ | → | $n =$ ______ |
| **10.** | $^-21 - {}^-12 = n$ | → | $^-12 + n = {}^-21$ | → | $n =$ ______ |
| **11.** | $^-45 - {}^-15 = n$ | → | $^-15 + n = {}^-45$ | → | $n =$ ______ |
| **12.** | $^-70 - {}^+20 = n$ | → | $^+20 + n = {}^-70$ | → | $n =$ ______ |
| **13.** | $^+30 - {}^-20 = n$ | → | $^-20 + n = {}^+30$ | → | $n =$ ______ |
| **14.** | $^+78 - {}^+78 = n$ | → | $^+78 + n = {}^+78$ | → | $n =$ ______ |

WORK SPACE

# Review

**1.** Round 13,532,674 to the nearest thousand. ______

**2.** Rename using decimal numerals.

MDIV ______ MDLXIII ______

**3.** Rename using Roman numerals.

1,510 ______ 2,009 ______

**4.** Rename using base-six numerals.

105 ______$_{six}$ 215 ______$_{six}$ 151 ______$_{six}$

**5.** Rename using base-ten numerals.

$404_{eight}$ ______ $333_{nine}$ ______ $560_{seven}$ ______

**6.** Show the solution set of whole numbers for each sentence.

- $n + 5 > 8$ ______
- $n + 3 < 9$ ______
- $7 < n + 3$ ______
- $1 + n < 6$ ______

**7.** X = {0, 2, 4, 6} Y = {0, 1, 3, 5}

From the sets above list the members in

- $X \cup Y =$ ______
- $X \cap Y =$ ______

WORK SPACE

**8.** Carol uses $1\frac{3}{4}$ yards of trimming to make a place mat. How much will the trimming cost for 20 mats at 14¢ a yard? ______

**9.** Mr. Bailey caught one fish that weighed $1\frac{3}{4}$ pounds, one that weighed $1\frac{1}{2}$ pounds, and another that weighed $2\frac{1}{4}$ pounds. All three fish weighed ______ pounds.

**10.** Mary had $5\frac{1}{4}$ yards of ribbon. She used $2\frac{7}{8}$ yards. She has ______ yards left.

**11.** How many columns $2\frac{1}{2}$ inches wide can be laid out on a sheet of paper 15 inches wide? ______

**12.** There are 1,564 students and 46 teachers in a high school. What is the average number of students per teacher? ______

**13.** Ethel may buy 3 pairs of socks for $1.00 at a sale. At this rate she may buy ______ pairs for $4.00.

**14.** At the rate of 42.5 miles an hour, how long will it take to go 255 miles? ______

# Review

**1.** Rename, using decimals.

$\frac{3}{10}$ ____ 24% ____

$\frac{5}{100}$ ____ 52% ____

$\frac{8}{1,000}$ ____ 99% ____

**2.** Rename, using fractions.

0.1 ____ 20% ____

1.9 ____ 50% ____

0.003 ____ 5% ____

**3.** Rename, using per cents.

$\frac{2}{5}$ ____ 0.15 ____

$\frac{3}{4}$ ____ 0.60 ____

$\frac{1}{3}$ ____ 1.25 ____

**4.**

**a** $\begin{array}{r} 3\text{ gal. }3\text{ qt.} \\ +\ 4\text{ gal. }3\text{ qt.} \\ \hline \end{array}$

**b** $\begin{array}{r} 4\text{ hr. }30\text{ min.} \\ -\ 2\text{ hr. }40\text{ min.} \\ \hline \end{array}$

**c** $\begin{array}{r} 4\text{ yd. }2\text{ ft.} \\ \times\ 7 \\ \hline \end{array}$

**d** $4\overline{)5\text{ lb. }4\text{ oz.}}$

**5.** $^{-}11 - {}^{+}7 =$ ____ $^{+}12 + {}^{-}30 =$ ____ $^{-}20 - {}^{-}7 =$ ____ $^{-}14 + {}^{-}18 =$ ____

**6.** $^{+}14 - {}^{+}14 =$ ____ $^{-}32 + {}^{+}19 =$ ____ $^{-}18 - {}^{+}8 =$ ____ $^{+}90 + {}^{+}40 =$ ____

**7.** A basketball court may be as large as 50 feet by 94 feet. What is the distance around the court? ____

**8.** If you have 17 out of 20 homework examples correct, you have ____% of the examples correct.

**9.** Find the area of a field 220 feet long and 140 feet wide.

____

**10.** Find the volume of a rectangular bin 24 feet long, 15 feet wide, and $4\frac{1}{2}$ feet high. ____

**11.** If one gallon of water weighs 8.33 pounds, how many pounds will the water weigh in a tank with a capacity of 2,500 gallons?

____

**12.** Pete works in a clothing store. For a 15% discount sale, what sale price should he mark on $45 suits? ____ on $60 topcoats? ____

**13.** The wholesale price on a suit is $40. The retail price is $50, or ____% greater.

**14.** Ray's father is an automobile salesman. His rate of commission is 5% on used cars and 8% on new cars. What was his total commission if he sold a new car at $2,815 and a used car at $1,310? ____

WORK SPACE

# Problem Test 8

**1.** A recipe for 12 people calls for 3 pounds of beef. If 9 pounds of meat is used _____ people could be served.

**2.** If paid in ten days, a 2% discount is allowed on a gas bill that amounts to $6.80. What is the actual amount paid? ________

**3.** In 682.5 miles of driving, Mr. Mills used 35 gallons of gasoline. What was the average number of miles per gallon? _____

**4.** How many fence stakes $3\frac{1}{2}$ feet long can be cut from two 14-foot poles? _____

**5.** Last summer Bob's older brother earned $620 and put $93 in the bank. What per cent of his earnings did he save? _____

**6.** If a jet plane can fly $12\frac{1}{2}$ miles per minute, how many minutes would it take to fly 100 miles? _____

**7.** On the first day of a 1,200-mile trip, Jean's family drove 540 miles. What per cent of the trip had they completed? _____

**8.** Mr. Barr receives 8% commission for selling sporting goods. What is Mr. Barr's commission on an order of $752? ________

**9.** On a 15-day motor trip, the Adams' family spent $464.97. What was their average expense per day? ________

**10.** Television rights to telecast a university's football games yield 27% of the gate receipts. If the gate receipts amount to $78,500, how much does the university receive for the television rights? ________

Number correct: _____. Date: ____________ ___, ______.
Write your score on the Problem Test Record on page 160. Fill in the eighth bar in the Problem Test graph form on page 160.

| | |
|---|---|
| 1 | |
| 2 | |
| 3 | 4 |
| 5 | |
| 6 | |
| 7 | |
| 8 | |
| 9 | 10 |

# Review

**1.**

$$\begin{array}{r} 3,372 \\ 8,476 \\ 2,853 \\ 1,832 \\ +9,526 \\ \hline \end{array} \qquad \begin{array}{r} 7.907 \\ 8.750 \\ 9.999 \\ 3.883 \\ +7.291 \\ \hline \end{array} \qquad \begin{array}{r} 129.63 \\ 83.27 \\ 125.80 \\ 247.92 \\ +\ \ 49.08 \\ \hline \end{array}$$

**2.**

$$\begin{array}{r} 458.7 \\ -284.6 \\ \hline \end{array} \qquad \begin{array}{r} 50.08 \\ -27.69 \\ \hline \end{array} \qquad \begin{array}{r} 7.003 \\ -2.734 \\ \hline \end{array}$$

**3.**

$$\begin{array}{r} 13.05 \\ \times\ \ 3.08 \\ \hline \end{array} \qquad \begin{array}{r} 385.5 \\ \times\ \ 0.26 \\ \hline \end{array}$$

**4.** $8.56 \div$ _____ $= 0.856$

**5.** $4.009 \times$ _____ $= 400.9$

**6.** $53.21 \times 100 =$ _______

**7.** $897.2 \div 1{,}000 =$ _______

**8.**

$7.2\overline{)2.808}$ $\qquad$ $5.6\overline{)0.4424}$

**9.**

$1.73\overline{)640.1}$ $\qquad$ $0.75\overline{)9.879}$

# Progress Test 8

**1.** Rename, using a decimal: Seven and five hundred two thousandths. _______

**2.** Rename, using an exponent.

$7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 \times 7 =$ _____

**3.** In lowest terms, what is the ratio of 15 to 10? _____ of 10 to 15? _____

**4.** Rename, using fractions.

$33\frac{1}{3}\% =$ _____ $\qquad$ $87\frac{1}{2}\% =$ _____

**5.** What numbers from the set of whole numbers 0 to 10 will make this sentence true? $n + 2 < 10$ _______________

**6.** Find 48% of 452. _____

**7.** A rectangle is 35.2 inches long and 14.7 inches wide. The perimeter is _____ inches.

**8.** Find the area of a rectangle 15.6 inches long and 7.5 inches wide. _______

**9.** A plane flying 9.5 miles per minute will fly _____ miles in 3 hours.

**10.** If Jane has read 7 pages of a 63-page book, what per cent of the book has she read? _____

WORK SPACE

Number correct: _____. Date: __________ ____, ______.
Write your score in the Progress Test Record on page 160. Fill in the eighth bar on the graph form for Progress Tests on page 160.

# Tables of measurement

### TIME

60 seconds (sec.) make 1 minute (min.)
60 minutes make 1 hour (hr.)

### LENGTH

12 inches (in.) make 1 foot (ft.)
3 feet make 1 yard (yd.)
36 inches make 1 yard
5,280 feet make 1 mile (mi.)

### WEIGHT

16 ounces (oz.) make 1 pound (lb.)
2,000 pounds make 1 ton (T.)
2,240 pounds make 1 long ton

### LIQUID

8 fluid ounces (fl. oz.) make 1 cup (c.)
2 cups make 1 pint (pt.)
2 pints make 1 quart (qt.)
4 quarts make 1 gallon (gal.)
32 fluid ounces make 1 quart
4 cups make 1 quart

### AREA

144 square inches (sq. in.) make 1 square foot (sq. ft.)
9 square feet make 1 square yard (sq. yd.)
1,296 square inches make 1 square yard

### VOLUME

1,728 cubic inches (cu. in.) make 1 cubic foot (cu. ft.)
27 cubic feet make 1 cubic yard (cu. yd.)
46,656 cubic inches make 1 cubic yard

### LENGTH

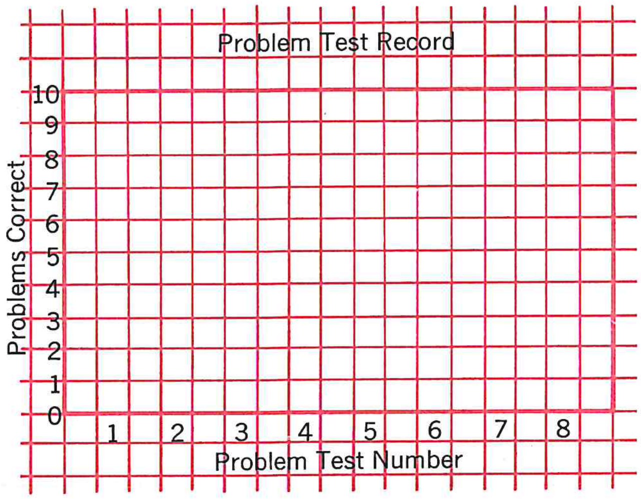
(Metric System)

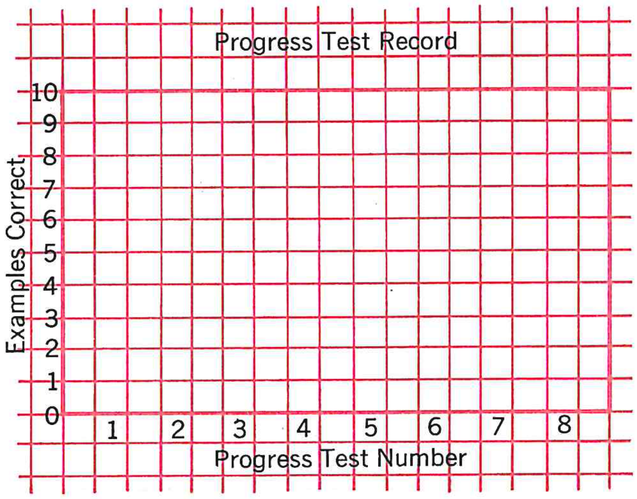
10 millimeters (mm) make 1 centimeter (cm)
10 centimeters make 1 decimeter (dm)
10 decimeters make 1 meter (m)
10 meters make 1 dekameter (dkm)
10 dekameters make 1 hectometer (hm)
10 hectometers make 1 kilometer (km)

## A RECORD OF MY TESTS

| Problem Test | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Problems Correct | | | | | | | | |

| Progress Test | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Examples Correct | | | | | | | | |





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# 6 Elementary Mathematics
# WORKBOOK

by Robert Oldehoff

To accompany *Elementary Mathematics 6*
by Joseph N. Payne, George A. Spooner,
Caroline H. Clark, Leslie S. Beatty, David W. Wells

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